# GEOTECHNICAL EXPLORATION

SANTA CLARA VALLEY WATER DISTRICT
CREEK MODIFICATION PROJECT

PART II

ADOBE CREEK AT ALMA STREET
PALO ALTO, CALIFORNIA

CH2M HILL

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# GEOTECHNICAL EXPLORATION

# SANTA CLARA VALLEY WATER DISTRICT
# CREEK MODIFICATION PROJECT

## PART II

## ADOBE CREEK AT ALMA STREET
## PALO ALTO, CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER
FRANK M. CORPUZ
Frank M. Corpuz
No. GE 238
Exp 3/31/91
GEOTECHNICAL
STATE OF CALIFORNIA

Prepared for

SANTA CLARA VALLEY WATER DISTRICT

by

CH2M HILL, CALIFORNIA, INC.
2107 North First Street, Suite 350
San Jose, California 95131

July 1988

CH2M HILL

SANTA CLARA VALLEY WATER DISTRICT
CREEK MODIFICATION PROJECT PART II
ADOBE CREEK AT ALMA STREET

SUBJECT: Addendum to Geotechnical Report Dated July 1988

PROJECT: SFO24297.B1

DATE: November 10, 1988

PREPARED BY: John E. Anderson

The geotechnical report for Adobe Creek at Alma Street recommends that backfill be compacted to "at least 90 percent relative compaction, per ASTM D1557" and that foundation stabilization material and crushed rock ballast be compacted to "at least 90 percent of the maximum density as defined by ASTM D4253." It is my understanding that the SCVWD lab will be doing the quality control testing for the project and that they do not have the equipment for doing tests according to ASTM (and AASTHO) standards. They are set up to perform the testing using Caltrans standards. Therefore, specification requirements need to be adjusted to accommodate this.

The Caltrans method of determining relative compaction is California Test 216. This standard, however, is not equivalent to ASTM D1557. ASTM D1557 has a higher amount of compactive effort (56,000 ft-lb/ft$^3$) per cubic foot of soil than California Test 216 (35,000 to 42,000 ft-lb/ft$^3$). Because of this difference backfill should be compacted to "at least 92 percent of the maximum density as defined by California Test 216."

Caltrans has no equivalent test to ASTM D4253 (Maximum Index of Soils Using a Vibratory Table). Therefore, the options are 1) leave the density requirement for foundation stabilization material and ballast as is and have the SCVWD send the samples to an outside lab to do this testing; 2) require that such materials be compacted with a minimum of three passes of a vibratory compactor; or 3) require that the in-place density of the material be at least 130 pounds per cubic foot.

In addition, the report recommends a minimum of 12 inches of foundation stabilization material beneath the base slab. This can be decreased to 6 inches.

CONTENTS

| | Page |
|---|---|
| Introduction | 1 |
| Purpose and Scope | 1 |
| Limitations | 1 |
| Project Location and Site Description | 2 |
| Project Description | 2 |
| Exploration and Testing | 3 |
| Field Exploration | 3 |
| Laboratory Testing | 4 |
| Presentation of Subsurface Information | 4 |
| Site Conditions | 5 |
| Subsurface Conditions | 5 |
| Geology and Seismicity | 5 |
| Conclusions and Recommendations | 6 |
| General | 6 |
| Earthwork | 6 |
| Design and Construction of Bridge Modification Alternative | 10 |
| Design Groundwater Level | 11 |
| Foundations | 11 |
| Settlement | 11 |
| Seismic Design | 13 |
| Lateral Earth Pressures | 13 |
| Construction Considerations | 14 |

Figures

Appendix A. Field Exploration
Appendix B. Laboratory Testing

# INTRODUCTION

## PURPOSE AND SCOPE

This report presents the results of the geotechnical exploration conducted by CH2M HILL for the proposed modification to the Adobe Creek channel at Alma Street and at the Southern Pacific Transportation Company (SPTC) railroad tracks, in Palo Alto, California. The location of the site is shown on the vicinity map, Figure 1. These modifications are part of a project sponsored by the Santa Clara Valley Water District to increase the capacity of the Adobe Creek channel. Proposed creek modifications include lowering the existing channel. This modification will require changing the existing Alma Street bridge and replacing the existing bridge crossing at the SPTC railroad tracks, as shown in the Site Plan, Figure 2.

The purpose of this exploration was to provide geotechnical recommendations for the proposed bridge and modifications to the existing bridge. The recommendations are based on the following scope of work:

- Subsurface exploration
- Groundwater level monitoring
- Laboratory testing
- Engineering analysis of data
- Preparation of this report

## LIMITATIONS

This report has been prepared for the exclusive use of the Santa Clara Valley Water District for specific application to the proposed Adobe Creek crossings at Alma Street and the SPTC railroad tracks, in accordance with generally accepted geotechnical engineering practice. No other warranty, expressed or implied, is made.

The analyses and recommendations contained in this report are based on the data obtained from a site reconnaissance, and the soil borings. The borings indicate soil conditions only at specific locations and times, and only to the depths penetrated. They do not necessarily reflect strata variations that may exist between boring locations. During construction, if subsurface conditions vary from those described herein, recommendations in this report may need to be re-evaluated.

CH2M HILL is not responsible for any claims, damages, or liability associated with interpretation or reuse by others of the subsurface data, or engineering analyses by others using the information contained in this report.

## PROJECT LOCATION AND SITE DESCRIPTION

The project site is located adjacent to Alma Street between Ely Place and Greenmeadow Way, in Palo Alto, California, as shown in Figure 1.

The existing crossing at Alma Street consists of two contiguous bridges, founded on spread footing foundations at relatively shallow depths below the channel invert. The existing west-bound portion of the crossing was built around 1957. The date of construction for the east-bound portion is 1923. The channel-bridge section is rectangular, approximately 17 feet wide, and has continuous spread footings below each wall founded about 12-1/2 feet below Alma Street grade.

The date of construction for the existing railroad bridge is not known. This arch bridge has a base width of approximately 17 feet, with a channel invert about 16 feet below the rail grade.

Between Alma Street and the railroad, the channel sides slope at inclinations of about 4 horizontal to 5 vertical (4:5), and are lined with sacked concrete slope protection. To the north of Alma Street and to the south of the SPTC railroad tracks, the existing channel is a trapezoidal, concrete-lined section.

## PROJECT DESCRIPTION

In order to increase its capacity, the Adobe Creek channel is to be lowered and lined with concrete under Alma Street and the SPTC railroad tracks. It is proposed to lower the existing channel by about 2 feet and convert the trapezodial channel to a concrete, U-frame channel.

In a concurrent, separate analysis, CH2M HILL has been evaluating several alternative construction schemes for the creek modification at these crossings. These alternatives include:

- Conventional, cast-in-place, concrete bridge over a new, concrete-lined channel, with rail traffic carried on using shooflies and auto traffic using detours during construction

- Precast concrete bridge installed during periods of low traffic, thus allowing lane closures or single track operations

- Replacing the existing bridges with a cast-in-place, reinforced concrete, box culvert with installation by open cut and cover using detours and shooflies

- Lowering the existing bridge structure walls by underpinning and cross-bracing construction methods and constructing a base slab across the bottom of the lowered walls

The railroad's primary concerns include the time frame for construction, distress to the railroad tracks during construction, and the magnitude of any long-term, post-construction differential settlement of the railroad tracks as a result of the construction. Replacement of the existing arch bridge with a cast-in-place, reinforced concrete, box culvert is the selected alternative for the railroad crossing. SPTC has established that scheduled rail service along the track shall not be disrupted as a result of the proposed construction. Therefore, a double shoofly will be installed to carry rail traffic around the construction site.

The preferred alternative for the Alma Street bridge is to underpin and lower the existing channel bottom. The proposed construction method for underpinning and lowering the existing Alma Street Bridge is to use internal cross-bracing (struts) acting against the walls of the existing bridge structure, while performing any required underpinning work. This alternative results in the least disruption to traffic and also minimizes construction costs.

The borings and associated laboratory testing reported herein were used to perform a geotechnical evaluation of all the above-noted crossing alternatives. During this study, the alternatives were narrowed by the project design team. The conclusions and recommendations presented in this report are directed toward the recommended alternatives described above. Information from the borings, which extended to depths of 100 feet, and associated laboratory testing can be used for further geotechnical evaluation of other alternatives, including alternatives using deep foundations.

## EXPLORATION AND TESTING

### FIELD EXPLORATION

Exploratory soil borings were drilled between October 5 and October 8, 1987. Three borings (AB-1 through AB-3) were made to depths ranging from approximately 85 to 100 feet below the ground surface. Boring locations are presented in Figure 2. Field boring logs are presented in Appendix A.

All borings were vertically advanced with a CME 75 drilling rig using hollow-stem augers. These borings were performed under direct observation of a CH2M HILL engineer. The drilling rig was equipped with a manually operated hammer for Standard Penetration Tests (SPT).

Disturbed soil samples were obtained at various intervals by the SPT sampler. The number of blows required to drive the sampler one foot was recorded and reported on the boring logs as the N-value. Relatively undisturbed soil samples were obtained with a thin-walled push sampler (Shelby tubes). All recovered samples were visually classified by a CH2M HILL engineer in the field in general accordance with ASTM D 2488, Visual-Manual Procedure for Description and Identification of Soils. In addition, most cohesive soil samples were tested with a Pocket-Penetrometer (PPT) or Torvane (TV). The SPT was performed in approximate accordance with ASTM D 1586. Thin-walled sampling was performed in approximate accordance with ASTM D 1587.

## LABORATORY TESTING

Samples obtained during the field exploration were sent to Harding Lawson Associates' laboratory in Novato, California. Disturbed samples were selected for index properties testing to confirm field classifications and to determine pertinent engineering properties. These tests consisted of natural moisture content, Atterberg limits, and sieve analysis tests. In addition, unconsolidated undrained triaxial shear strength, consolidated undrained triaxial shear strength, and unit weight tests were performed on undisturbed Shelby tube samples. The tests were performed in general accordance with applicable ASTM standards. Results of the laboratory tests are presented in Appendix B.

## PRESENTATION OF SUBSURFACE INFORMATION

### Field Boring Logs

Field boring logs are presented in Appendix A along with a boring log legend. The field boring logs are a simplified representation of subsurface conditions encountered during the exploration. Some simplification has been necessary because of uncertainties inherent in soil classification. The ground surface elevations noted on the boring logs were interpolated from the project site topographic map.

### Interpretive Boring Logs

Interpretive boring logs are presented in Figures 3, 4, and 5 and include both field and laboratory test results. Detailed results of the field and laboratory tests are presented in Appendices A and B, respectively. The interpretive logs represent a synthesis of the field and laboratory data obtained at each boring location. Lines separating strata on these logs are estimates of the location of stratification changes and may not be representative of conditions at other locations and times.

## SITE CONDITIONS

### SUBSURFACE CONDITIONS

#### Soil Conditions

The surface soils at the site consist of stiff, lean to fat clay to depths of approximately 10 feet. Underlying the surface soils, medium dense, well graded to clayey sand and stiff, sandy clay were encountered to depths of approximately 20 feet. At a depth of approximately 20 feet, soft to firm elastic silt/fat clay was encountered to depths of 25 feet. Below a depth of 25 feet, predominantly firm to very stiff clays and interbedded medium dense to dense sands were encountered to the maximum depths explored of 101.5 feet.

#### Groundwater Conditions

Groundwater was encountered at depths ranging from 18 to 24 feet below the surface during drilling. Piezometers were installed in Borings AB-2 and AB-3 to monitor fluctuations. On October 8 and November 23, 1987, groundwater was measured at a depth of 17.5 feet below the surface in Borings AB-2 and AB-3.

Information on any additional groundwater readings made by CH2M HILL before construction bid advertisement would be made available along with the subsurface information contained in this report.

### GEOLOGY AND SEISMICITY

A detailed evaluation of site geology and seismicity and their associated hazards is not within the scope of this report. It should be noted, however, that the San Francisco Bay area is one of the most active seismic areas in the United States. The site is 6 miles northeast of the San Andreas fault. Based upon available regional information there are no faults located at the site. However, because of the proximity and activity of major regional faults, the site is located within Zone 4 of the Uniform Building Code's seismic design provisions.

# CONCLUSIONS AND RECOMMENDATIONS

## GENERAL

From a geotechnical viewpoint, the proposed bridge modification and box culvert alternatives are feasible, provided that the following conclusions and recommendations are incorporated into the design and construction of the project. The primary geotechnical features of concern include:

### Open-Cut and Cover Box Culvert at Railroad Crossing

- Stability and safety of temporary cut slopes during construction
- Stability of subgrade soils during construction
- Post-construction settlement of backfill adjacent to box and below railroad tracks
- Rebound settlement of natural clay soils underlying box culvert

### Underpinning and Lowering of Alma Street Bridge

- Construction period lateral forces for design of temporary internal struts
- Length and location of underpinning pits
- Sequence of construction to remove temporary struts and place permanent base slab

Detailed conclusions and recommendations are presented in the following sections of this report.

## EARTHWORK

### Excavation

Based upon the available subsurface information, required excavations for the open-cut and cover box culvert alternatives can likely be made with standard earthmoving equipment after dewatering has been accomplished. Hand excavation may be required for the Alma Street bridge modification underpinning.

### Dewatering

To minimize construction considerations and the potential for adverse impacts, it is recommended that the proposed construction take place near the end of the summer months or in early autumn when the groundwater is expected to be at its lowest. Excavation for the open-cut alternative, or excavation for underpinning will likely require some form of dewatering.

The method of dewatering should be the responsibility of the Contractor. Furthermore, it should be the responsibility of the Contractor to properly control the groundwater internal and external to the excavation in order to properly complete the project, maintain safety of the excavation, and not adversely affect adjacent property.

### Stability and Safety of Temporary Excavations

The Contractor should be responsible for all temporary slopes excavated at the site and the design of any required temporary shoring. Shoring and bracing should be provided by the Contractor in accordance with the governing safety requirements, and the design should account for areas where heavy equipment will be operated or stored near the top of the excavation.

At the base of unshored excavations, adequate distance should be provided between the toe of slope and confined working areas at the base of the excavation, to ensure workers' protection from ravelling slope material and debris.

The design of shoring and cribbing for underpinning pits should be the responsibility of the Contractor, and should be performed by a qualified Registered Structural Engineer.

### Embankment Material for Shoofly

Embankment material for temporary shoofly construction should be predominantly granular, with a plasticity index of less than 15 percent, no rocks or lumps greater than 6 inches in greatest dimension, less than 15 percent greater than 2.5 inches, and free of organics and debris.

Any required import ballast or sub-ballast material for the railroad should meet the specification requirements of the railroad.

### Material For Backfill

Due to settlement considerations, it is recommended that soils removed from onsite excavations not be used for backfill in areas immediately adjacent to or above the box culvert, and below the railroad tracks. The following recommendations for backfill are provided for drained and undrained conditions. A schematic cross-section and summary of the backfill recommendations are shown in Figure 6, Backfill Recommendations.

Drained Conditions. For drained conditions, in the area adjacent to the box culvert, free draining gravel consisting of other Class 1-Type B, or Class 2 Permeable Material per Section 68, Caltrans Standard Specifications, latest edition, should be used as backfill in a zone at least 2 feet in width adjacent to the box culvert sidewalls. Use of Class 1B Permeable Material would require a geotextile filter fabric between the permeable material and the structural backfill. Use of Class 2 Permeable Material would not require a geotextile filter fabric. To facilitate drainage, a minimum 4-inch diameter perforated PVC pipe should be placed within the permeable material blanket and near the base of the box culvert sidewalls. The pipe should be outletted to a suitable discharge point.

Beyond a distance of 2 feet from the box culvert sidewalls, and outside the limits of the railroad tracks, onsite excavated soils may be used as structural backfill. Imported structural backfill should be predominantly granular, with a plasticity index of less than 15 percent, no rocks or lumps greater than 6 inches in greatest dimension, less than 15 percent greater than 2.5 inches, and free of organics and debris.

Undrained Conditions. For undrained conditions, free-draining gravel would not be required adjacent to the box culvert sidewalls. Backfill should consist of imported structural backfill as previously described for drained conditions. Beyond a distance of 2 feet from the box culvert sidewalls, and outside the limits of the railroad tracks, onsite excavated soils can be used as structural backfill.

### Railroad Ballast and Sub-ballast Materials

For the limits of the overlying railroad ballast or roadway section to be replaced, permeable material and structural backfill should extend to within 12 inches of the bottom of the railroad ballast, and the remaining 12 inches should be backfilled with sub-ballast material. The permeable material and structural backfill should be separated from the sub-ballast by a synthetic, geotextile filter fabric. Any required import ballast or sub-ballast material for the railroad should meet the specification requirements of the railroad.

### Soil Cap Materials

Beyond the toe of the ballast section, the upper 12 inches of backfill should consist of onsite or imported clayey soils to provide a relatively impermeable soil cap. A filter fabric should be placed between Class 1B Permeable Material backfill and the soil cap.

## Foundation Stabilization

For the open cut and cover alternative and bridge modification alternatives, the box culvert and new base slab should be underlain by a minimum of 12 inches of foundation stabilization material. The foundation stabilization material should extend a minimum of 6 inches beyond the plan view limits of the box culvert for the open-cut alternative and for the full extent of the excavation for the bridge modification alternative, including underpinning pits. Grade for the foundation stabilization material should be established by over-excavating below the required depth for the base mat of the box culvert or bridge modification alternatives.

The foundation stabilization material should consist of a durable, 2-1/2-inch minus, well-graded gravel with less than 5 percent passing the No. 200 sieve.

## Geotextile

Geotextile should be used to enclose the Class 1B Permeable Material backfill adjacent to the sidewalls for the box culvert alternative. Geotextile should be placed between the natural soils, imported or onsite structural backfill, and the Class 1B Permeable Material backfill. In addition, geotextile should be placed directly over the Class 1B Permeable Material before placing soil cap fill or railroad sub-ballast materials.

The geotextile should have the following minimum properties:

| | |
|---|---|
| Grab tensile strength, ASTM D1682 | 120 lbs |
| Trapezoidal tear, ASTM D1117-80 | 50 lbs |
| Mullen Burst, ASTM D3786-80a | 210 psi |
| Equivalent Opening Size | 70 to 100 |

## Subgrade Observation

Before placing foundation stabilization material for the open cut and cover alternative, the exposed and dewatered subgrade should be observed by a qualified geotechnical specialist or an experienced construction inspector working under the direction of a geotechnical specialist. The purpose of the observation would be to verify subgrade conditions as anticipated from the soil borings.

Based upon our field exploration and a review of the boring logs, it is anticipated that a variety of soil conditions could be encountered at proposed subgrade elevations, including pockets of medium dense to loose sand and soft clay. Any extensive areas of soft, loose, or unstable soils should be over-excavated and replaced with foundation stabilization material.

### Placement and Compaction of Fill

Foundation stabilization material and crushed rock ballast should be placed in loose, uncompacted lift thicknesses not exceeding 6 inches and compacted to at least 90 percent of the maximum index density as defined in ASTM D4253, latest edition.

Structural backfill permeable material, fill in areas adjacent to structures, and fill that will support structures or other facilities should be placed in loose, uncompacted lift thicknesses not exceeding 6 inches in thickness and compacted to at least 90 percent relative compaction, per ASTM D 1557, latest edition.

The Contractor should be responsible for structural integrity of the sidewalls of the box culvert during backfilling operations.

## DESIGN AND CONSTRUCTION OF BRIDGE MODIFICATION ALTERNATIVE

### Design of Internal Struts

For the design of temporary internal struts, the temporary lateral pressures presented in Figure 7 are recommended.

These pressures assume that the existing bridge deck acts as a temporary strut and that the following recommendations for underpinning pits and sequence of construction are incorporated into the design and construction of the project.

### Length and Location of Underpinning Pits

Because of traffic considerations, the approach of underpinning from beneath the existing bridge at the creek elevation is the preferred alternative. For this approach, extensive underpinning, shoring, and cribbing will be required to laterally support a maximum of approximately 16 feet of soil overburden. The segment of individual underpinning pits should be based upon the ability of the structure to span the length, and the maximum allowable bearing pressure to limit construction period settlement resulting from redistribution of load to the supporting foundation.

To determine the maximum allowable length of excavation for the underpinning pits to limit settlement, an allowable bearing pressure of 3,000 pounds per square foot of total load should be used for redistribution of sustained dead structure load to footing sections adjacent to the undermined section. At this pressure, it is estimated that during construction, total settlement would be on the order of 3/4-inch or less, and differential settlement would be on the order of 1/2-inch or less.

### Load Transfer

Load transfer to the completed new wall and underlying base slab section should be accomplished by jacking against the overlying existing structure to 150 percent of the design dead load, and dry pack grouting (or shotcreting) between the existing and new structure. By jacking, the soil below the new foundation level can be proof-loaded. This is accomplished by jacking and holding 150 percent of the design dead load until an acceptable settlement rate is achieved. During this operation, the majority of the estimated post-construction soil settlement from the lowered foundation should occur.

### Sequence of Construction

For each underpinning section, the base slab and walls should be poured and set, and load transfer completed before the associated internal supporting strut is removed. Underpinning and transfer of load should be accomplished in alternating sections.

## DESIGN GROUNDWATER LEVEL

For proposes of structural design for undrained conditions (i.e., no provisions for drainage and relief of hydrostatic pressures behind walls), a groundwater level at elevation 32 is recommended for use in design. This design groundwater level should be considered as a relatively short-duration, low-frequency event.

## FOUNDATIONS

For the box culvert and bridge modification alternatives, the maximum bearing pressure for dead plus backfill live loads has been estimated for the minimum dimensions of the box. This maximum bearing pressure is considered low enough to preclude a bearing capacity failure for dead plus backfill live loads.

For design purposes, the maximum bearing pressure should not exceed an allowable value of 1,750 psf for dead plus live loads, and 2,000 psf for all loads including transient wind or seismic loads.

## SETTLEMENT

### Post-Construction Settlement For Open Cut Alternative

For the earthwork recommendations presented above, the largest contributor to post-construction differential settlement would be the rebound and recompression of underlying, clayey, subgrade soils. The actual amount of settlement will depend on the amount of time the excavation is left open and the dead weight of the structure and overlying backfill.

Based upon an estimated range of structure dead weight and full rebound, estimated total settlement for the open-cut and cover alternatives would be on the order of 1-1/2 inches or less for settlement due to rebounding recompression effects. Most of this settlement would occur as the load is applied during construction.

Estimated post-construction differential settlement of the box culvert would be on the order of 1/2 inch to 3/4 inch or less over a one year period following construction for settlement due to rebounding recompression effects. In addition, settlement on the order of 1/2 inch to 1 inch will probably occur within the adjacent new backfill and new ballast due to fill settlement and train loading over a period of one year after completion of construction. This settlement would result in a surface expression and deflection of the overlying railroad. The railroad grade can be maintained by adding additional ballast as required.

Post-construction of the railroad tracks will likely be accomplished by SPTC according to arrangements with SCVWD.

### Post-Construction Settlement for Bridge Modification Alternative

During construction for the bridge modification, some rebounding/recompression of underlying clay soils and redistribution of loads will occur, resulting in post-construction settlement in addition to the construction period settlement previously described. Estimated post-construction differential settlement of the completed structure would be about 1-inch or less over a one year period following construction, assuming that the above recommendations are followed for design and construction of the bridge modification alternative. It is estimated that additional differential settlement on the order of 1/2 to 3/4 inch or less could occur if the above recommendations for load transfer and sequence of construction are not incorporated into the project. For the bridge modification alternative, it should be anticipated that some post-construction releveling of the roadway surface by overlaying with asphalt will be required. This is a relatively standard maintenance procedure for roadways. Materials for roadway overlay should comply with the appropriate transportation agency standards and requirements.

## SEISMIC DESIGN

The seismic design should be based on the condition that the site is located within Zone 4 of the Uniform Building Code's seismic design provisions.

One seismic hazard considered for this site is soil liquefaction. Liquefaction occurs in saturated, loose, granular soils when water pressures within the soil build up during ground shaking and temporarily reduce soil strength, allowing it to deform. The subsurface information disclosed by the borings indicates the presence of medium dense, well-graded sand, and clayey sand between 10 and 20 feet in Boring AB-1 to depths of 30 feet below grade. Based upon the medium dense condition and fine content of the clayey sands, liquefaction potential at the site is low and the proposed construction should not be affected by this hazard.

Recommendations for seismic design earth pressure loads for the box culvert sections are discussed in the following subsection, Lateral Earth Pressures.

## LATERAL EARTH PRESSURES

The sidewalls for the box culvert or modified bridge alternative should be designed to resist both lateral earth pressures and any additional lateral loads caused by surcharge loads on the adjoining ground above. It is recommended that the sidewalls be designed for a lateral, at-rest, triangular earth pressure of 75 psf per foot of depth for static drained conditions, where some form of drainage and hydrostatic relief is provided behind the wall.

For undrained conditions, triangular, lateral hydrostatic pressure of 100 psf per foot of depth should be used starting at the design groundwater level.

In addition to the lateral, at-rest earth pressure, sidewalls should be designed to resist one-half of vertically applied surcharge loads on the surface, applied laterally against the wall.

For analysis of seismic earth pressure effects, a triangular, lateral earth pressure of 45 psf per foot of depth plus a rectangular, uniform pressure of 20H psf is recommended for design use, where H is the wall height in feet. These recommended pressures are for seismic loading conditions, which are separate from the recommended, static, lateral earth pressures presented above. Therefore, these pressures for seismic loading conditions are not combined with pressures for static loading conditions.

## CONSTRUCTION CONSIDERATIONS

It is neither the intent of this report nor within the scope of geotechnical work to recommend construction methods or procedures. For the proposed facilities, it is the responsibility of the Contractor to implement sound construction methods and procedures in accordance with the strictest governing safety standards.

Variations in soil and geologic conditions are possible and may be encountered during construction. All earthwork and foundation subgrade preparation should be performed under the observation of a geotechnical specialist.

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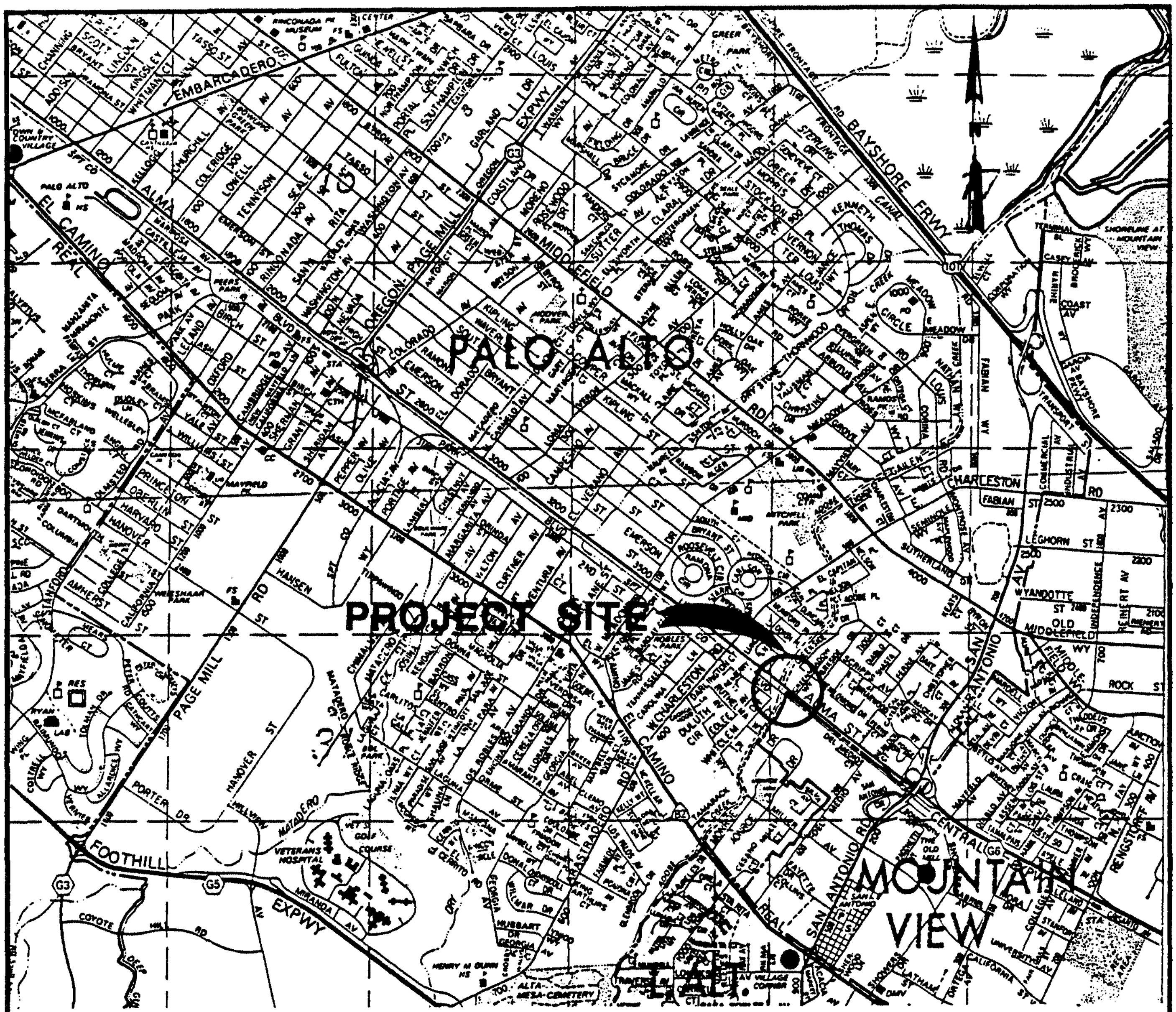
# FIGURES



NO SCALE

FIGURE 1

VICINITY MAP

CH2M HILL

F24297.A1

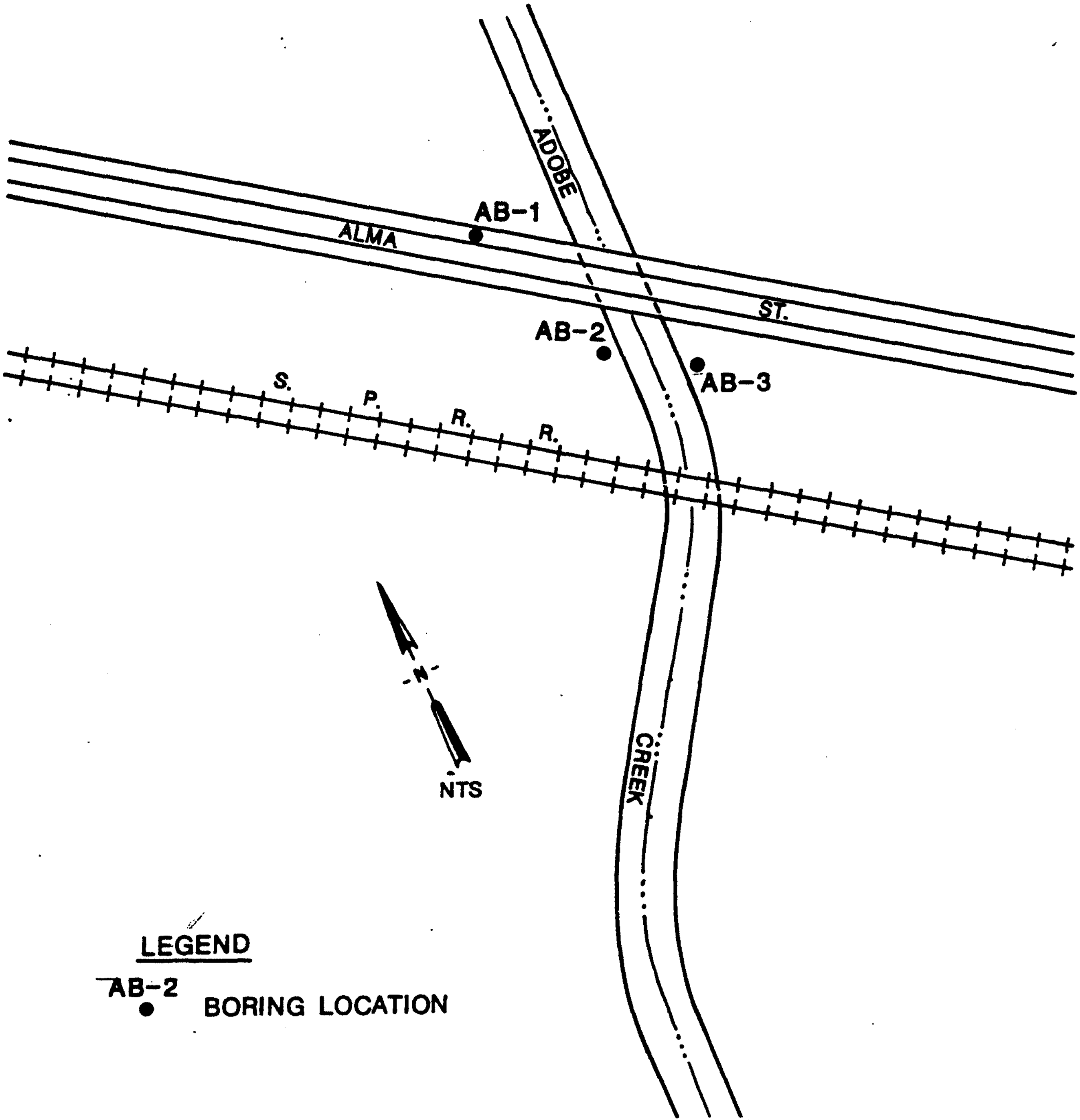


**FIGURE 2**
**SITE PLAN AND APPROXIMATE BORING LOCATIONS-ADOBE CREEK PALO ALTO, CALIFORNIA**

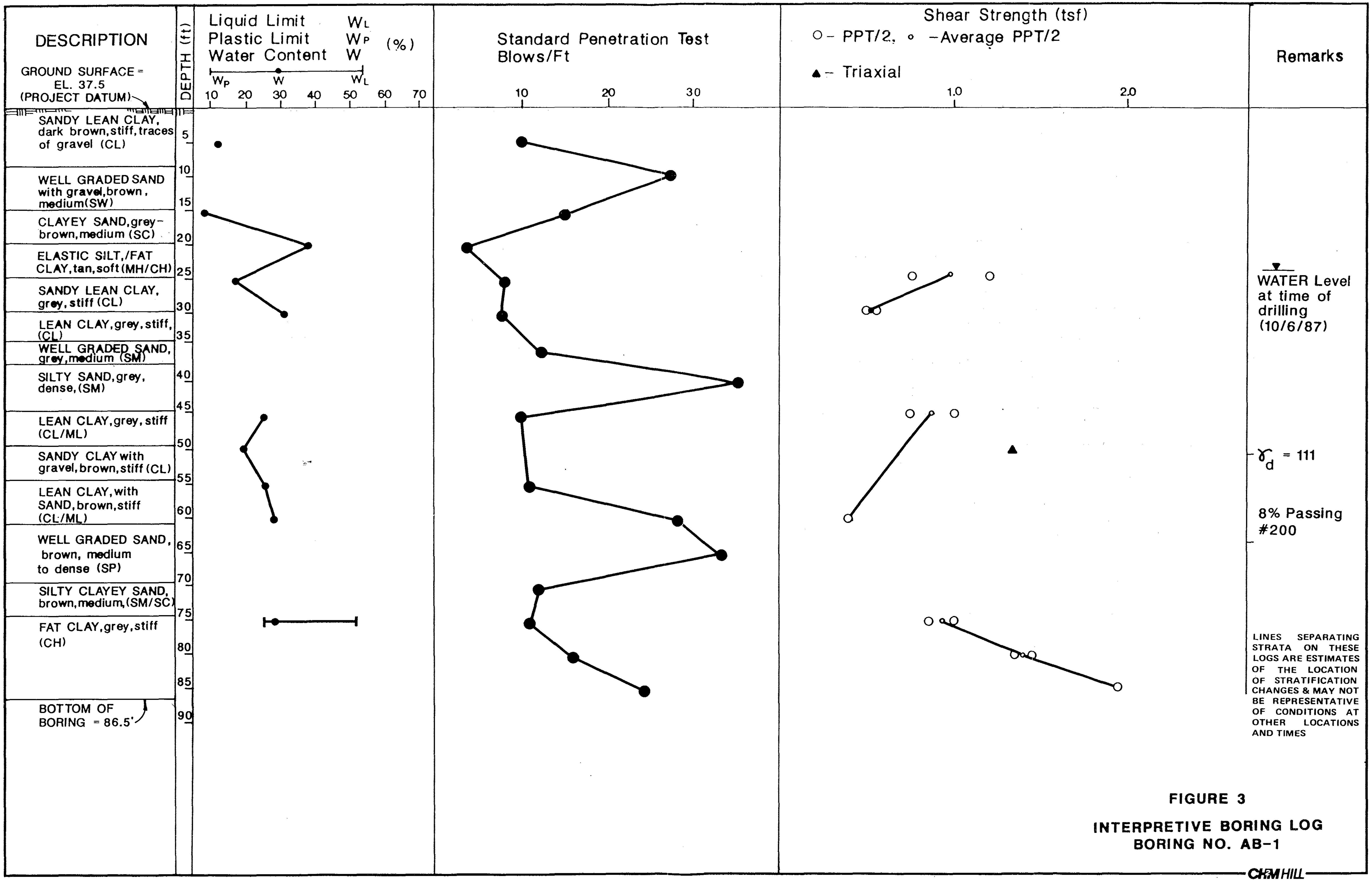


**FIGURE 3**

**INTERPRETIVE BORING LOG**
**BORING NO. AB-1**

CH2M HILL

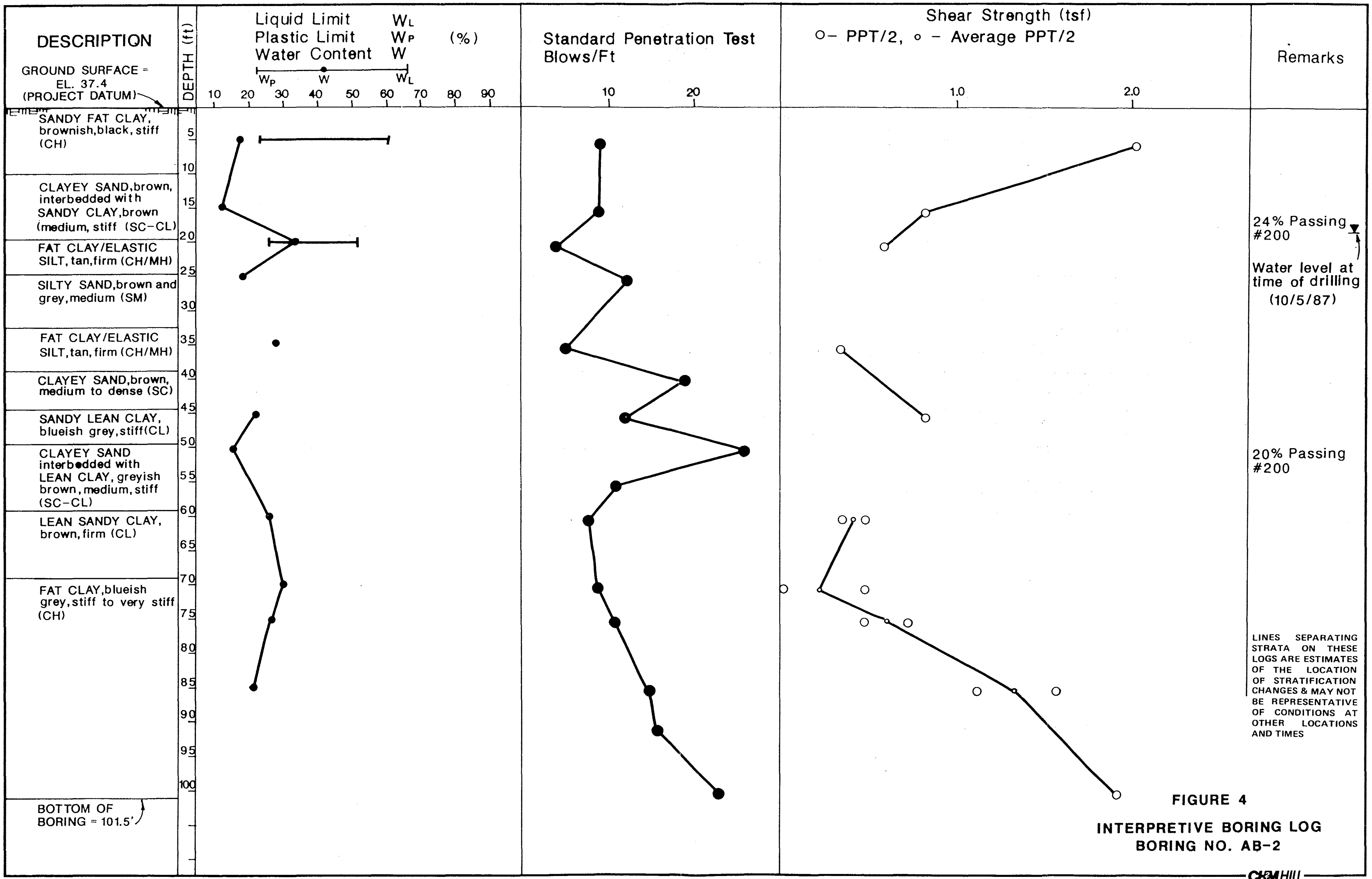


**FIGURE 4**

**INTERPRETIVE BORING LOG**
**BORING NO. AB-2**

CH2M HILL

F24297.A1

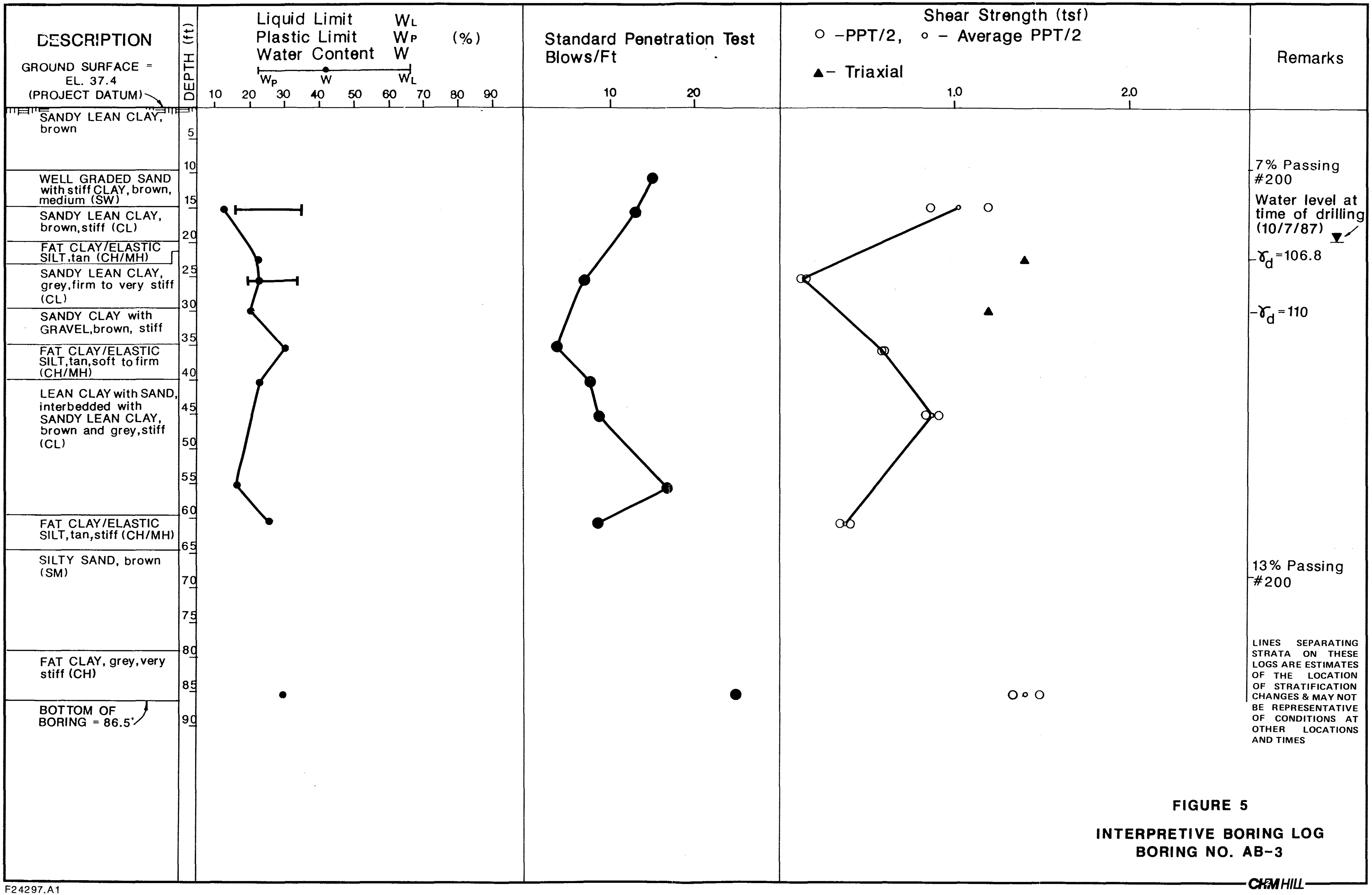
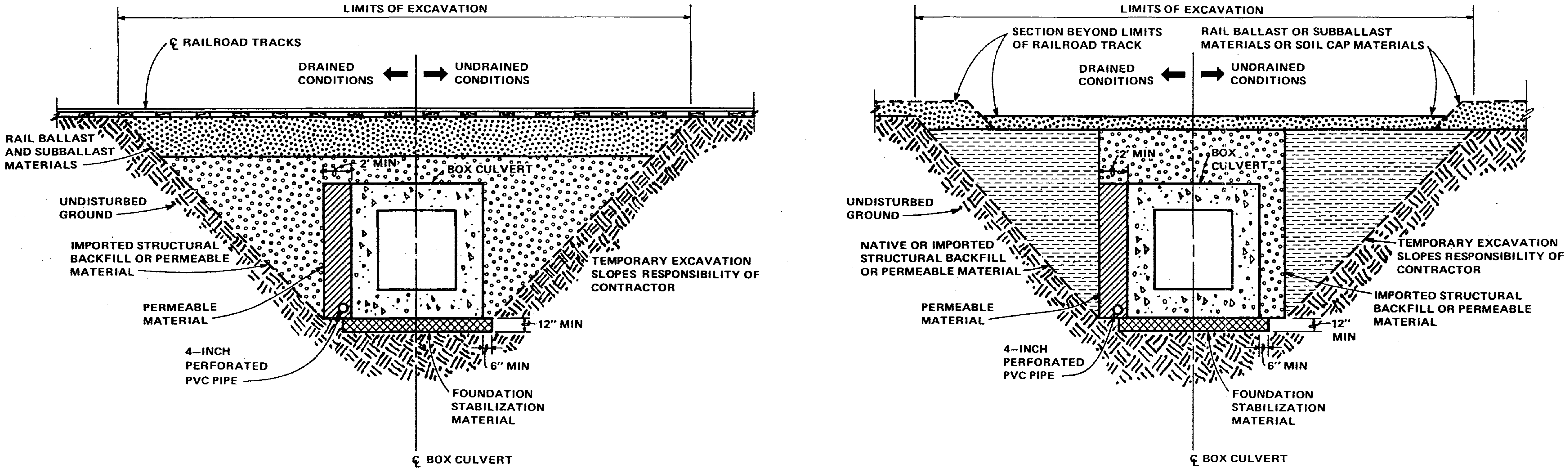


**FIGURE 5**

**INTERPRETIVE BORING LOG**
**BORING NO. AB-3**

CH2M HILL

F24297.A1

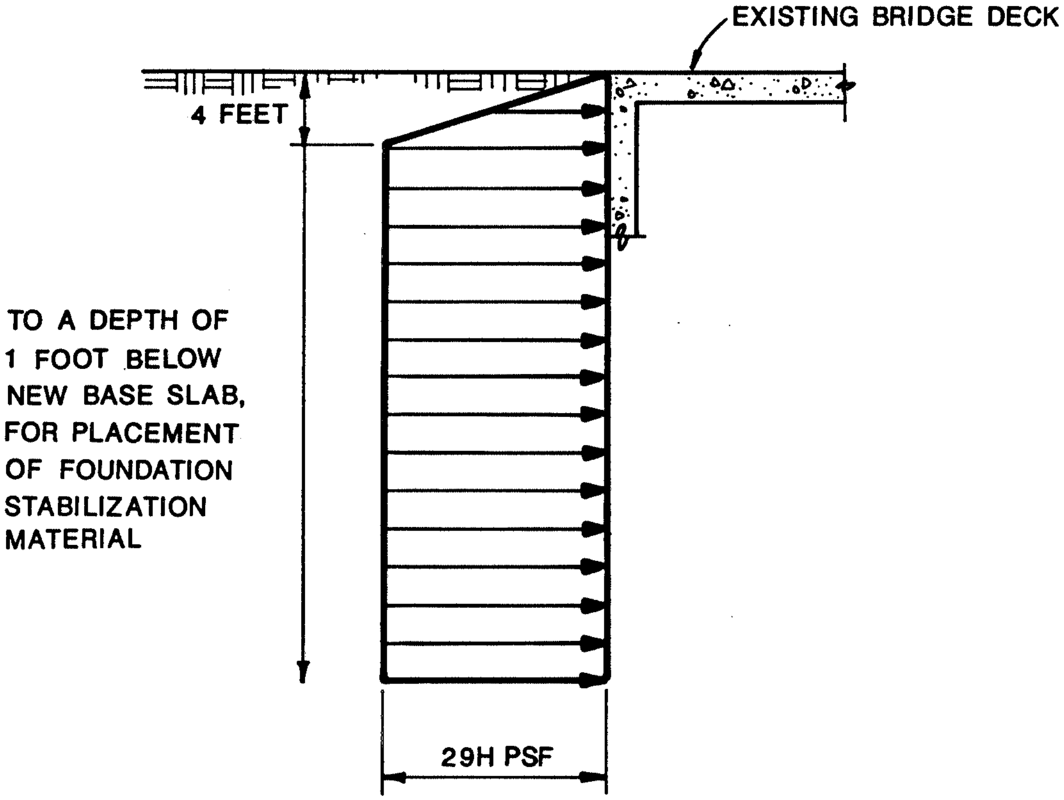

LIMITS OF EXCAVATION
℄ RAILROAD TRACKS
DRAINED CONDITIONS
UNDRAINED CONDITIONS
RAIL BALLAST AND SUBBALLAST MATERIALS
UNDISTURBED GROUND
IMPORTED STRUCTURAL BACKFILL OR PERMEABLE MATERIAL
PERMEABLE MATERIAL
4–INCH PERFORATED PVC PIPE
2' MIN
BOX CULVERT
TEMPORARY EXCAVATION SLOPES RESPONSIBILITY OF CONTRACTOR
12" MIN
6" MIN
FOUNDATION STABILIZATION MATERIAL
℄ BOX CULVERT
LIMITS OF EXCAVATION
SECTION BEYOND LIMITS OF RAILROAD TRACK
RAIL BALLAST OR SUBBALLAST MATERIALS OR SOIL CAP MATERIALS
DRAINED CONDITIONS
UNDRAINED CONDITIONS
UNDISTURBED GROUND
NATIVE OR IMPORTED STRUCTURAL BACKFILL OR PERMEABLE MATERIAL
PERMEABLE MATERIAL
4–INCH PERFORATED PVC PIPE
2' MIN
BOX CULVERT
TEMPORARY EXCAVATION SLOPES RESPONSIBILITY OF CONTRACTOR
IMPORTED STRUCTURAL BACKFILL OR PERMEABLE MATERIAL
12" MIN
6" MIN
FOUNDATION STABILIZATION MATERIAL
℄ BOX CULVERT

BACKFILL RECOMMENDATIONS
BENEATH LIMITS OF RAILROAD TRACKS

BACKFILL RECOMMENDATIONS
BEYOND LIMITS OF RAILROAD TRACKS

**FIGURE 6**

**BACKFILL RECOMMENDATIONS**


EXISTING BRIDGE DECK
4 FEET
TO A DEPTH OF 1 FOOT BELOW NEW BASE SLAB, FOR PLACEMENT OF FOUNDATION STABILIZATION MATERIAL
29H PSF

RECOMMENDED LATERAL EARTH PRESSURE FOR SIZING OF TEMPORARY STRUTS DURING CONSTRUCTION PERIOD, DRAINED CONDITIONS.

H = HEIGHT OF EXISTING WALL PLUS DEPTH OF EXCAVATION, IN FEET,FOR UNDERPINNING PIT.

**FIGURE 7**

**CONSTRUCTION EARTH PRESSURES FOR STRUT DESIGN**

# APPENDIX A--FIELD EXPLORATION

## BORING AND TEST PIT LOG LEGEND:

SAMPLE TYPE:

B - BAG SAMPLE
J - JAR SAMPLE
S - SPLIT BARREL (ASTM D1586 UNLESS OTHERWISE NOTED)
W - WASH SAMPLE
ST - SHELBY TUBE
OT - OSTERBERG TUBE
NX - DIAMOND CORE BARREL

STANDARD PENETRATION TEST:

6"-6"-6" - THE NUMBER OF BLOWS FOR THREE 6-INCH INCREMENTS REQUIRED FROM A 140-LB HAMMER FALLING 30 INCHES TO DRIVE A STANDARD 2-INCH O.D. SPLIT-BARREL SAMPLER (ASTM D1586)

(N) - THE SUM OF BLOWS FOR THE SECOND AND THIRD 6-INCH INCREMENTS

SYMBOLIC LOG:

SEE SYMBOLIC LOG LEGEND FOR KEY TO GRAPHIC PATTERN

## NOTES:

1. THE BORING AND/OR TEST PIT LOGS AND RELATED INFORMATION DEPICT SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC LOCATIONS AND DATES INDICATED. SOIL CONDITIONS AND WATER LEVELS AT OTHER LOCATIONS MAY DIFFER FROM CONDITIONS OCCURRING AT THESE BORING AND/OR TEST PIT LOCATIONS. ALSO, THE PASSAGE OF TIME MAY RESULT IN A CHANGE IN THE CONDITIONS AT THESE LOCATIONS.

2. BORINGS AND/OR TEST PITS WERE LOGGED IN THE FIELD BY A CH2M HILL ENGINEERING GEOLOGIST OR GEOTECHNICAL ENGINEER. SAMPLES WERE EXAMINED AND VISUALLY CLASSIFIED IN APPROXIMATE ACCORDANCE WITH ASTM D2488.

**FIGURE A-1**

**BORING AND TEST PIT LOG LEGEND**

CH2M HILL

| PROJECT NUMBER | BORING NUMBER | SHEET 1 OF 3 |
|---|---|---|
| F24297.A1.03 | AB-1 | |

# SOIL BORING LOG

PROJECT SCVWD Bridges LOCATION Palo Alto

ELEVATION 37.5 MSL DRILLING CONTRACTOR HEW Drilling Co.

DRILLING METHOD AND EQUIPMENT CME 75, HSA

WATER LEVEL AND DATE 24' 10/5/87 START 9:30 10/2/87 FINISH 3:00 10/5/87 LOGGER S Madsen

| DEPTH BELOW SURFACE (FT) | SAMPLE | | | STANDARD PENETRATION TEST RESULTS | SOIL DESCRIPTION | SYMBOLIC LOG | COMMENTS |
|---|---|---|---|---|---|---|---|
| | INTERVAL | TYPE AND NUMBER | RECOVERY (FT) | 6"-6"-6" (N) | SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL | | DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION |
| 0 | | | | | | | |
| 5 | | S-1 | 1' | 4 5 5<br>(10) | SANDY LEAN CLAY, dk brown, dry, stiff, traces of gravel, fill (CL) | | |
| 10 | | S-2 | 1' | 10 12 15<br>(27) | WELL-GRADED SAND WITH GRAVEL, brown, moist, medium (SW) | | |
| 15 | | S-3 | 1' | 4 6 9<br>(15) | CLAYEY SAND, greyish brown, moist, medium, traces of gravel (SC) | | |
| 20 | | S-4 | 1.3 | 1 2 2<br>(4) | ELASTIC SILT / FAT CLAY, tan, moist, soft (MH/CH) | | |
| | | | | | | | Driller notes sandy soil at 23½'<br>▽ water level at the of drilling |
| 25 | | S-5 | 1.2 | 3 3 5<br>(8) | SANDY LEAN CLAY, grey, moist, stiff (CL) | | PPT = 2.4, 1.5 TSF |

CH2M HILL

| PROJECT NUMBER | BORING NUMBER | |
|---|---|---|
| F24297.A1.03 | AB-1 | SHEET 2 OF 3 |

# SOIL BORING LOG

PROJECT SCVWD Bridges LOCATION Palo Alto

ELEVATION 37.5 MSL DRILLING CONTRACTOR HEW Drilling Co.

DRILLING METHOD AND EQUIPMENT CME 75, HSA

WATER LEVEL AND DATE 24' 10/5/87 START 9:30 10/5/87 FINISH 300 10/5/87 LOGGER S. Modsen

| DEPTH BELOW SURFACE (FT) | SAMPLE | | | STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N) | SOIL DESCRIPTION SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL | SYMBOLIC LOG | COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION |
|---|---|---|---|---|---|---|---|
| | INTERVAL | TYPE AND NUMBER | RECOVERY (FT) | | | | |
| 30 | | S-5 | 1.0 | 4 4 5<br>(9) | LEAN CLAY, grey, moist, stiff (CL) | | PPT=1.6, 2.4 TSF |
| 35 | | S-6 | 0.8 | 5 5 6<br>(11) | WELL GRADED SAND, grey and brown, moist, medium (SW) | | |
| 40 | | S-7 | 1.2 | 8 16 20<br>(36) | SILTY SAND, grey, moist, dense (SM) | | |
| 45 | | S-8 | 1.5 | 3 5 4<br>(9) | LEAN CLAY with SAND, grey, moist stiff (CL) | | PPT= 1.6, 2.0 TSF |
| 50 | | ST-9 | 2.0 | PUSH | SANDY CLAY - with GRAVEL, grey, moist very stiff (CL) | | |
| 55 | | S-10 | 1.5 | 4 5 5<br>(10) | LEAN CLAY with SAND, brown, dry to moist, stiff (CL) | | |

CH2M HILL

PROJECT NUMBER F24297.A1.03

BORING NUMBER AB-1

SHEET 3 OF 3

# SOIL BORING LOG

PROJECT SCVWD Bridges

LOCATION Palo Alto

ELEVATION 37.5 MSL

DRILLING CONTRACTOR HEW Drilling Co.

DRILLING METHOD AND EQUIPMENT CME 75 ; HSA

WATER LEVEL AND DATE 24' 10/5/87

START 9:30 10/5/87

FINISH 3:00 10/5/87

LOGGER S Madsen

| DEPTH BELOW SURFACE (FT) | SAMPLE | | | STANDARD PENETRATION TEST RESULTS | SOIL DESCRIPTION | SYMBOLIC LOG | COMMENTS |
|---|---|---|---|---|---|---|---|
| | INTERVAL | TYPE AND NUMBER | RECOVERY (FT) | 6"-6"-6" (N) | SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL | | DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION |
| 60 | | S-11 | 1.1 | 9 12 17<br>(29) | LEAN CLAY, brown, moist, firm (CL-ML) (sand at tip of sampler) | | PPT = 0.8 TSF |
| 65 | | S-12 | 1.0 | 10 15 19<br>(34) | WELL-GRADED SAND with CLAY, brown, moist, medium (SC) | | |
| 70 | | S-13 | 1.5 | 4 3 7<br>(10) | SILTY SAND/CLAYEY SAND, brown, moist, medium (SC-SM) | | |
| 75 | | S-14 | 1.5 | 5 4 5<br>(9) | FAT CLAY, blueish grey, moist, stiff (CH) | | PPT = 1.9, 1.7 TSF |
| 80 | | S-15 | 1.5 | 3 6 8<br>(14) | FAT CLAY, blueish grey, moist, very stiff (CH) | | PPT = 2.6, 2.4 TSF |
| 85 | | S-16 | 1.5 | 6 9 16<br>(25) | FAT CLAY, blueish grey, moist, very stiff (CH) | | PPT = 3.8 TSF |
| | | EOB | = 86.5 | | | | |

REV 7/86 FORM D1586

CH2M HILL

| PROJECT NUMBER | BORING NUMBER |
|---|---|
| F24297.A1.03 | AB-2 SHEET 1 OF 4 |

# SOIL BORING LOG

PROJECT SCVWD Bridges LOCATION Palo Alto - Adobe Creek

ELEVATION 37.4 MSL DRILLING CONTRACTOR HEW Drilling Co

DRILLING METHOD AND EQUIPMENT CME 75, HSA

WATER LEVEL AND DATE 10/6/87 ; 18' START 11:00 10/6/87 FINISH 5:00 10/6/87 LOGGER S. Madsen

| DEPTH BELOW SURFACE (FT) | SAMPLE | | | STANDARD PENETRATION TEST RESULTS | SOIL DESCRIPTION | SYMBOLIC LOG | COMMENTS |
|---|---|---|---|---|---|---|---|
| | INTERVAL | TYPE AND NUMBER | RECOVERY (FT) | 6"-6"-6" (N) | SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL | | DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION |
| 0 | | | | | SANDY FAT CLAY, brownish black, dry (CH) | | |
| 5 | | S-1 | .5 | 3 4 5<br>(9) | SANDY FAT CLAY, brownish black, dry, very stiff (CH) | | PPT= 4.1 TSF |
| 10 | | | | | | | |
| 15 | | S-2 | 1.5 | 2 3 6<br>(9) | CLAYEY SAND, brown, moist, medium (SC) interbedded with<br>SANDY CLAY, brown, moist, stiff (CL) | | PPT= 1.7 TSF |
| | | | | | | | ▽ Water level during drilling |
| 20 | | S-3 | 1.5 | 2 2 2<br>(4) | FAT CLAY/ELASTIC SILT, tan, moist, soft to firm (CH/MH) | | PPT= 1.2 |
| 25 | | S-4 | 1.0 | 8 7 5<br>(12) | CLAYEY SAND, brown and grey, wet, medium, sand grading fine to medium (SC) | | |

CH2M HILL

**PROJECT NUMBER** F24297.A1.03

**BORING NUMBER** AB-2

SHEET 2 OF 4

# SOIL BORING LOG

PROJECT SCVWD Bridges

LOCATION Palo Alto - Adobe Creek

ELEVATION 37.4

DRILLING CONTRACTOR HEW Drilling Co.

DRILLING METHOD AND EQUIPMENT CME 75, HSA

WATER LEVEL AND DATE 18'; 10/6/87

START 11:00 10/6/88

FINISH 5:00 10/6/88

LOGGER S Madsen

| DEPTH BELOW SURFACE (FT) | SAMPLE | | | STANDARD PENETRATION TEST RESULTS | SOIL DESCRIPTION | SYMBOLIC LOG | COMMENTS |
|---|---|---|---|---|---|---|---|
| | INTERVAL | TYPE AND NUMBER | RECOVERY (FT) | 6"-6"-6" (N) | SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL | | DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION |
| 30 | | | | | | | |
| 35 | | S-5 | 1.5 | 1 2 3<br>(5) | FAT CLAY/ELASTIC SILT, tan, moist, firm (CH/MH) | | PPT= 0.7 TSF |
| 40 | | S-6 | 1.5 | 4 9 10<br>(19) | CLAYEY SAND, brown, wet, medium (SC) | | |
| 45 | | S-7 | 1.5 | 3 6 6<br>(12) | SANDY LEAN CLAY, blueish grey, moist, stiff (CL) | | PPT= 1.7 TSF |
| 50 | | S-8 | 1.5 | 4 7 19<br>(26) | CLAYEY SAND, brown and grey, wet, medium (SC) | | |
| 55 | | S-9 | 1.5 | 3 5 6<br>(11) | LEAN CLAY, grey brown, wet, stiff interbedded with SAND WITH CLAY, greyish brown, wet, medium (CL+SC) | | |

CH2M HILL

| | |
|---|---|
| **PROJECT NUMBER**<br>F24297.A1.03 | **BORING NUMBER**<br>AB-2 SHEET 3 OF 4 |

## SOIL BORING LOG

PROJECT SCVWD Bridges LOCATION Polo Alto, Adobe Creek
ELEVATION 37.4 MSL DRILLING CONTRACTOR HEW Drilling Co.
DRILLING METHOD AND EQUIPMENT CME 75, HSA
WATER LEVEL AND DATE 18', 10/6/87 START 11:00 10/6/87 FINISH 5:00 10/6/87 LOGGER S. Madsen

| DEPTH BELOW SURFACE (FT) | SAMPLE | | | STANDARD PENETRATION TEST RESULTS | SOIL DESCRIPTION | SYMBOLIC LOG | COMMENTS |
|---|---|---|---|---|---|---|---|
| | INTERVAL | TYPE AND NUMBER | RECOVERY (FT) | 6"-6"-6" (N) | SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL | | DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION |
| 60 | | S-10 | 1.5 | 2 3 5<br>(8) | LEAN SANDY CLAY, brown, moist, firm (CL) | | PPT= 0.75, 1.0 TSF |
| 65 | | | | | | | |
| 70 | | S-11 | 1.5 | 3 3 6<br>(9) | ELASTIC SILT/FAT CLAY, grey, moist, soft to stiff, (MH/CH) | | PPT= 1.0 TSF<br>= 0.1 TSF in soft zones |
| 75 | | S-12 | 1.2 | 4 5 6<br>(11) | ELASTIC SILT/FAT CLAY, blueish grey, moist, stiff (MH/CH) | | PPT= 1.0, 1.5 TSF |
| 80 | | | | | | | |
| 85 | | S-13 | 1.5 | 3 5 10<br>(15) | FAT CLAY, blueish grey, moist, stiff (CH) | | PPT= 2.3, 3.2 TSF |
| | | | | | | | Thin lense of gravelly material at 89' |

CH2M HILL

|  |  |  |
|---|---|---|
| PROJECT NUMBER F24297.A1.03 | BORING NUMBER AB-2 | SHEET 4 OF 4 |

# SOIL BORING LOG

PROJECT SCVWD Bridges

LOCATION Palo Alto, Adobe Creek

ELEVATION 37.4

DRILLING CONTRACTOR HEW Drilling Co.

DRILLING METHOD AND EQUIPMENT CME 75; HSA

WATER LEVEL AND DATE 18'; 10/6/87

START 11:00 10/6/97

FINISH 5:00 10/6/97

LOGGER S Madsen

| DEPTH BELOW SURFACE (FT) | SAMPLE |  |  | STANDARD PENETRATION TEST RESULTS | SOIL DESCRIPTION | SYMBOLIC LOG | COMMENTS |
|---|---|---|---|---|---|---|---|
|  | INTERVAL | TYPE AND NUMBER | RECOVERY (FT) | 6"-6"-6" (N) | SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL |  | DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION |
| 90 |  |  |  |  |  |  | Driller noted layer of sand |
|  |  | S-14 | 1.5 | 5 7 9<br>(16) | ELASTIC SILT / FAT CLAY, blueish grey, moist, stiff (MH/CH) |  |  |
| 95 |  |  |  |  |  |  |  |
| 100 |  | S-15 | 1.5 | 6 10 13<br>(23) | FAT CLAY, blueish grey, moist, very stiff (CH) |  | PPT ~ 3.8 TSF |
|  |  | EOB | = 101.5' |  |  |  |  |

CH2M HILL

| PROJECT NUMBER | BORING NUMBER | |
|---|---|---|
| F24297.A1.03 | AB-3 | SHEET 1 OF 3 |

# SOIL BORING LOG

PROJECT SCVWD Bridges LOCATION Palo Alto - Adobe Creek

ELEVATION 37.4 MSL DRILLING CONTRACTOR HEW Drilling Co.

DRILLING METHOD AND EQUIPMENT CME 75; HSA

WATER LEVEL AND DATE 10/7/87; 16' START 11:45 AM 10/7/87 FINISH 10:00 AM 10/8/87 LOGGER S. Madsen

| DEPTH BELOW SURFACE (FT) | SAMPLE | | | STANDARD PENETRATION TEST RESULTS | SOIL DESCRIPTION | SYMBOLIC LOG | COMMENTS |
|---|---|---|---|---|---|---|---|
| | INTERVAL | TYPE AND NUMBER | RECOVERY (FT) | 6"-6"-6" (N) | SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL | | DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION |
| 0 | | | | | | | |
| 5 | | ST-1 | 2' | PUSH | SANDY LEAN CLAY, brown, moist, sand grading fine to coarse with trace gravel (CL) | | Pushing 700 psi |
| 10 | | S-2 | .8 | 6 7 8<br>(15) | WELL-GRADED SAND with CLAY, brown, moist, medium, grading fine to coarse with trace gravel (SW) | | |
| 15 | | S-3 | 1.0 | 2 7 6<br>(13) | SANDY LEAN CLAY, brown, dry stiff (CL) | | PPT= 2.4, 1.7 TSF<br>∇ water level during drilling |
| 20 | | ST-4 | 2.7 | PUSH | ELASTIC SILT/FAT CLAY WITH SAND, tan, moist, (CH/MH) | | Pushing 600 psi |
| 25 | | S-5 | 1.0 | 3 3 4<br>(7) | SANDY LEAN CLAY, grey, wet, soft to firm (CL) | | PPT=0.25, 0.25 TSF |

CH2M HILL

PROJECT NUMBER F24297.A1.03

BORING NUMBER AB-3

SHEET 2 OF 3

# SOIL BORING LOG

PROJECT SCVWD Bridges

LOCATION Palo Alto, Adobe Creek

ELEVATION 37.4 MSL

DRILLING CONTRACTOR HEW Drilling Co.

DRILLING METHOD AND EQUIPMENT CME 75, HSA

WATER LEVEL AND DATE 16' 10/7/87

START 11:45 10/7/87

FINISH 1000 10/8/77

LOGGER S Madsen

| DEPTH BELOW SURFACE (FT) | SAMPLE |  |  | STANDARD PENETRATION TEST RESULTS | SOIL DESCRIPTION | SYMBOLIC LOG | COMMENTS |
|---|---|---|---|---|---|---|---|
|  | INTERVAL | TYPE AND NUMBER | RECOVERY (FT) | 6"-6"-6" (N) | SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL |  | DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION |
| 30 |  | ST-6 | 1.2 | PUSH | SANDY LEAN CLAY w/ GRAVEL, brown, wet (CL) |  | Pushed 15" at 500psi then pressure up |
| 35 |  | S-7 | 1.5 | 2 2 2<br>(4) | FAT CLAY / ELASTIC SILT, tan, moist firm to stiff (NH/CH) |  | PPT = 1.2, 1.2 TSF |
|  |  |  |  |  |  |  | Driller notes 2 ft gravelly layer |
| 40 |  | S-8 | 1.5 | 2 4 4<br>(8) | LEAN CLAY WITH SAND, interbedded with SANDY LEAN CLAY, blueish gray, moist, firm (CL) |  | PPT = 1.2 in SANDY LEAN CLAY |
| 45 |  | S-9 | 1.5 | 4 4 10<br>(14) | SANDY LEAN CLAY interbedded with LEAN CLAY, brown, moist, stiff (CL) |  | PPT = 1.7, 1.8 TSF |
| 50 |  |  |  |  |  |  |  |
| 55 |  | S-10 |  | 3 6 11<br>(17) | SANDY CLAY, brown, wet, very stiff (CL) |  | Sand entered augers. Residue on sampler is clean poorly graded brown sand |

REV 7/86 FORM D1586

CH2M HILL

| PROJECT NUMBER | BORING NUMBER | |
|---|---|---|
| F24297.A1.03 | AB-3 | SHEET 3 OF 3 |

# SOIL BORING LOG

PROJECT SCVWD Bridges LOCATION Palo Alto, Adobe Creek

ELEVATION 37.4 MSL DRILLING CONTRACTOR HEW drilling Co.

DRILLING METHOD AND EQUIPMENT CME-75, HSA

WATER LEVEL AND DATE 10 START 11:45 10/7/87 FINISH 10:00 10/8/87 LOGGER S. Madsen

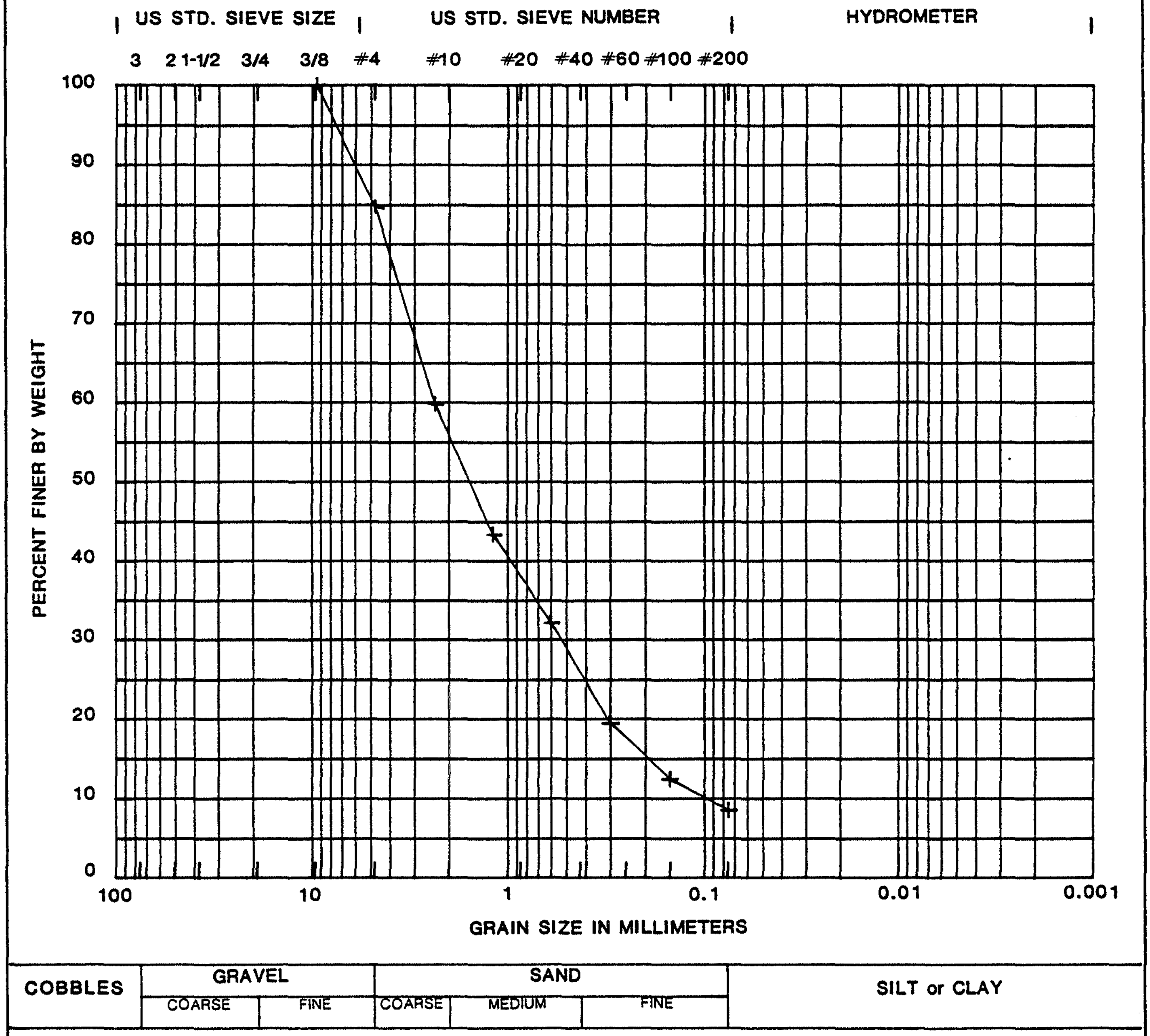
| DEPTH BELOW SURFACE (FT) | SAMPLE INTERVAL | SAMPLE TYPE AND NUMBER | SAMPLE RECOVERY (FT) | STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N) | SOIL DESCRIPTION SOIL NAME, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL | SYMBOLIC LOG | COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION |
|---|---|---|---|---|---|---|---|
| 60 | | S-11 | 1.5 | 3 4 5<br>(9) | FAT CLAY/ELASTIC SILT, tan, moist, stiff (CH/MH) | | PPT=0.7, 0.8 TSF |
| 65 | | S-12 | .3 | - | SILTY SAND, brown, wet (SM) | | Sampling in plug; only first 3" are undisturbed<br>Sand plug is very fine, silty, and grey |
| 70 | | | | | | | |
| 75 | | | | | | | Driller notes clay |
| 80 | | | | | | | |
| 85 | | S-13 | 1.5 | 6 9 15<br>(24) | FAT CLAY, grey, moist, very stiff (CH) | | PPT= 2.7, 3.0 TSF |
| | | EOB | = 86.5' | | | | |

REV 7/86 FORM D158

# APPENDIX B--LABORATORY TESTING

### Table B-1
### SUMMARY OF LABORATORY TEST RESULTS
### SCVWD-ADOBE CREEK MODIFICATIONS

| | | | | | | | Unconsolidated Undrained Triaxial Compression Test | | |
|---|---|---|---|---|---|---|---|---|---|
| Boring Number | Depth (ft) | Dry Density (pcf) | Moisture Content (%) | Liquid Limit (%) | Plastic Limit (%) | Plasticity Index | Confining Pressure (psf) | Shear Strength (psf) | Laboratory Description |
| AB-1 | 5.0 | | 12 | 41 | 22 | 19 | | | Sandy Clay, Brown (CL) |
| AB-1 | 15.0 | | 9 | | | | | | Clayey Sand, Brown (SC) |
| AB-1 | 20.0 | | 38 | | | | | | Clay, Brown (CL) |
| AB-1 | 25.0 | | 17 | | | | | | Clay, Black (CL) |
| AB-1 | 30.0 | | 32 | | | | | | Clay, Black (CL) |
| AB-1 | 45.0 | | 26 | | | | | | Clay, Black (CL) |
| AB-1 | 50.0 | 111 | 20 | | | | 2,300 | 2,702 | Sandy Clay, with Gravel (CL) |
| AB-1 | 55.0 | | 27 | | | | | | Clay, Brown (CL) |
| AB-1 | 60.0 | | 29 | | | | | | Sandy Silt, Brown (ML) |
| AB-1 | 60.5 | | | | | | | | Brown Sand w/Silt (SW-SM) (grain Size) |
| AB-1 | 75.0 | | 29 | 52 | 26 | 26 | | | Clay, Black (CH) |
| AB-1 | 85.0 | | 31 | | | | | | Clay, Grey (CL) |
| AB-2 | 5.0 | | 18 | 61 | 24 | 37 | | | Clay, Black (CH) |
| AB-2 | 15.0 | | 13 | | | | | | Clayey Sand, Brown (SC) |
| AB-2 | 20.0 | | 34 | 52 | 26 | 26 | | | Silty Clay, Brown (CH) |
| AB-2 | 25.0 | | 19 | | | | | | Silty Sand, Brown (SM) |
| AB-2 | 35.0 | | 26 | | | | | | Silty Clay, Brown (CL-ML) |
| AB-2 | 45.0 | | 23 | | | | | | Clay, Grey (CL) |
| AB-2 | 50.0 | | 16 | | | | | | Clayey Sand, Brown (SC) |
| AB-2 | 60.0 | | 26 | | | | | | Sandy Clay Brown (CL) |
| AB-2 | 70.0 | | 31 | | | | | | Silt, Dark Brown (ML) |
| AB-2 | 75.0 | | 28 | | | | | | Clay, Grey (CL) |
| AB-2 | 85.0 | | 22 | | | | | | Clayey Silt, Grey (CL-ML) |
| AB-3 | 10.0 | | | | | | | | Sand W/Silt, Brown (SP-SM) (grain size) |
| AB-3 | 15.0 | | 13 | 36 | 20 | 16 | | | Sandy Clay, Brown (CL) |
| AB-3 | 22.0 | 107 | 23 | | | | 1,600 | 2,417 | Sandy Clay, Grey, w/Gravel (CL) CU |
| AB-3 | 25.0 | | 23 | 34 | 21 | 14 | | | Sandy Clay, Black (CL) |
| AB-3 | 30.0 | 110 | 20 | | | | | | Sandy Clay, Brown, with Gravel (CL) |
| AB-3 | 35.0 | | 30 | | | | | | Silty Clay, Light Brown (ML-CL) |
| AB-3 | 40.0 | | 24 | | | | | | Silt, Black (ML) |
| AB-3 | 55.0 | | 17 | | | | | | Sandy Clay, Brown (CL) |
| AB-3 | 60.0 | | 26 | | | | | | Clay, Brown (CL) |
| AB-3 | 65.0 | | | | | | | | Silty Sand, Brown (SM) (grain size) |
| AB-3 | 85.0 | | 30 | | | | | | Clay, Grey (CL) |



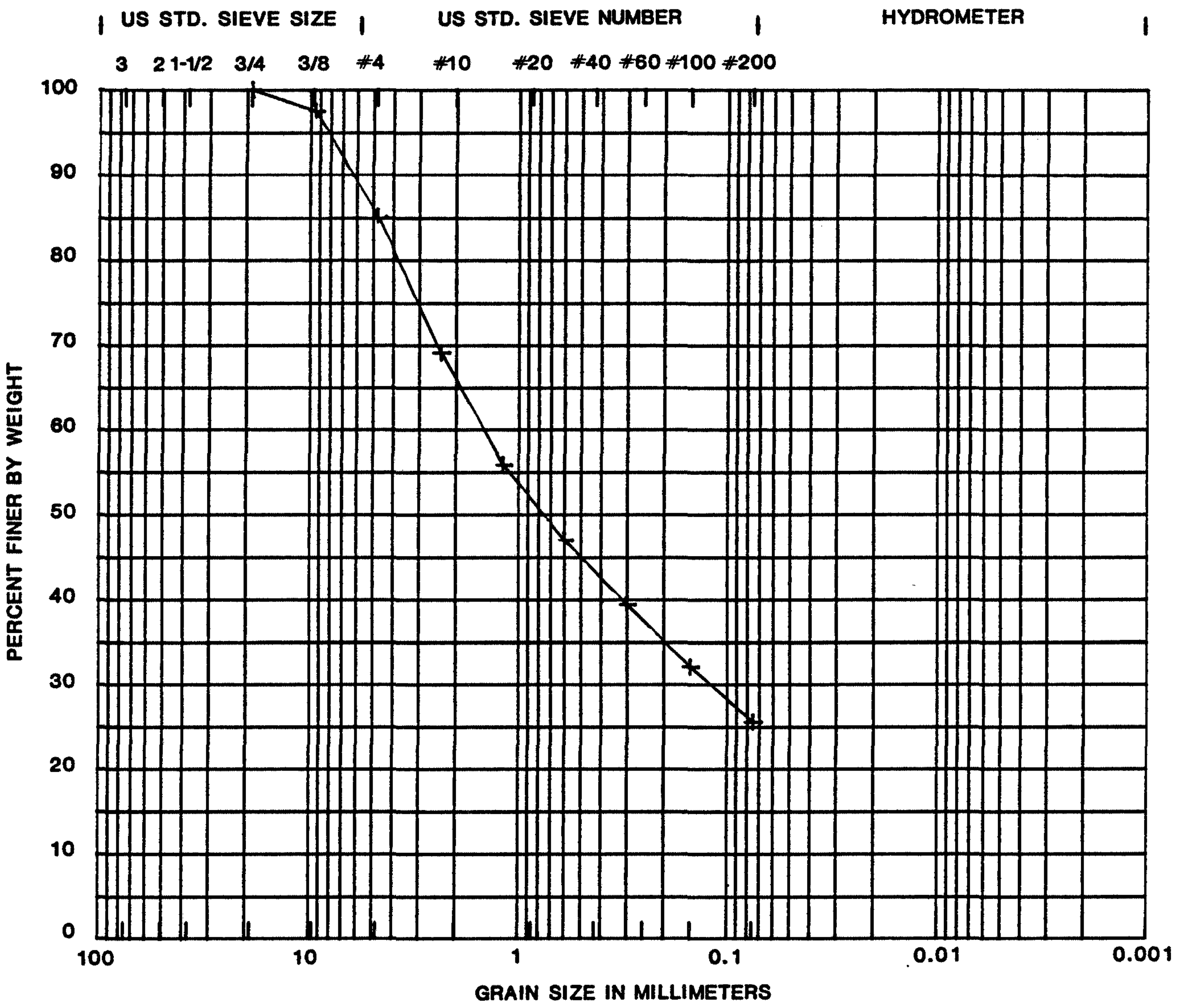
| SYMBOL | BORING NUMBER | DEPTH (feet) | CLASSIFICATION |
|---|---|---|---|
| + | AB-1 | 60.5 | BROWN SAND W/SILT (SW-SM*) |

**Harding Lawson Associates**
Engineers, Geologists
& Geophysicists

## Particle Size Analysis

PLATE

| DRAWN | JOB NUMBER | APPROVED | DATE | REVISED | DATE |
|---|---|---|---|---|---|
| | 05561.071.01 | | 10/87 | | |



| COBBLES | GRAVEL | | SAND | | | SILT or CLAY |
|---|---|---|---|---|---|---|
| | COARSE | FINE | COARSE | MEDIUM | FINE | |

| SYMBOL | BORING NUMBER | DEPTH (feet) | CLASSIFICATION |
|---|---|---|---|
| + | AB-2 | 15.0 | BROWN CLAYEY SAND (SC*) |

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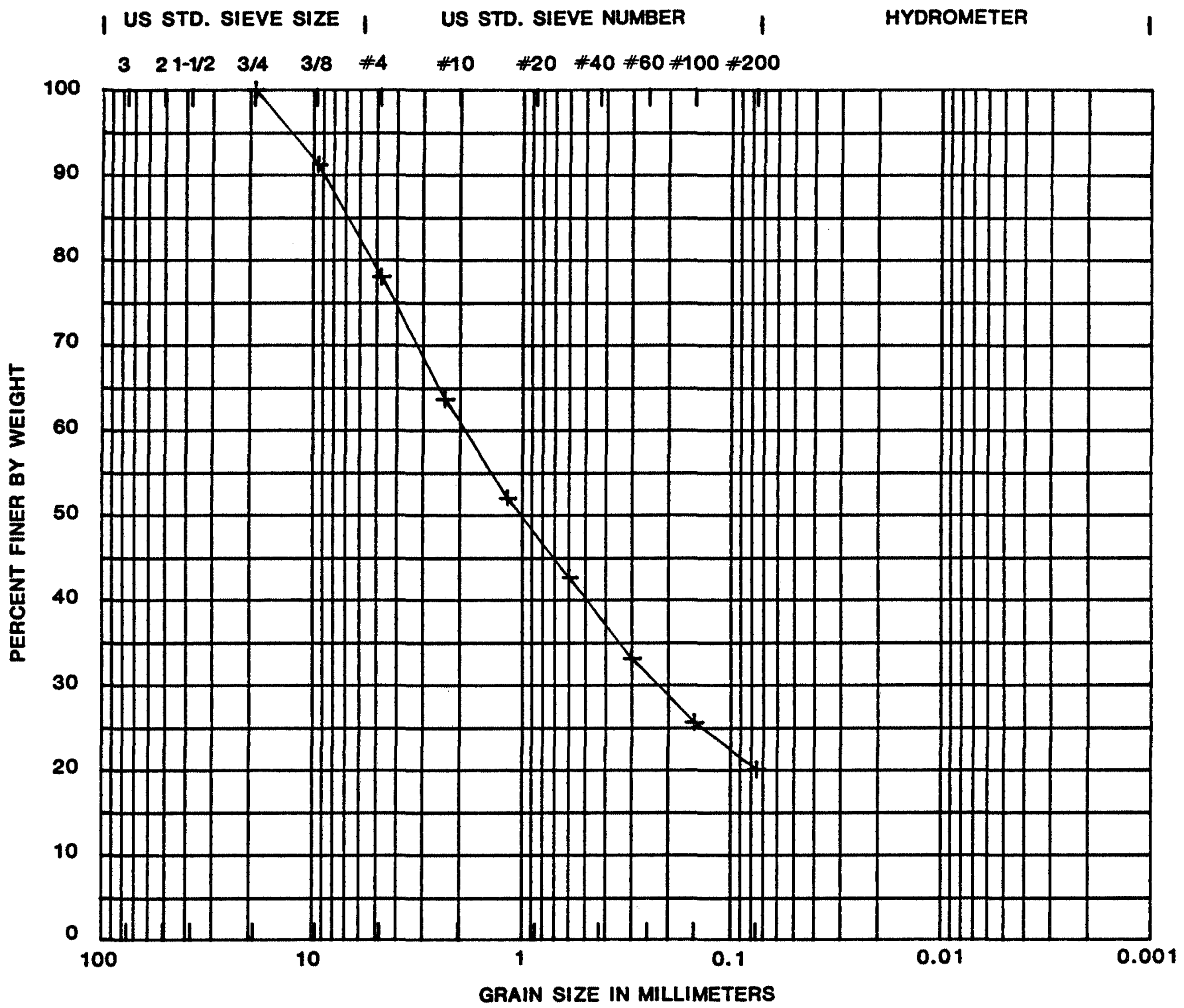
## Particle Size Analysis

PLATE

| DRAWN | JOB NUMBER | APPROVED | DATE | REVISED | DATE |
|---|---|---|---|---|---|
| | 05561.071.01 | | 10/87 | | |



| COBBLES | GRAVEL | | SAND | | | SILT or CLAY |
|---|---|---|---|---|---|---|
| | COARSE | FINE | COARSE | MEDIUM | FINE | |

| SYMBOL | BORING NUMBER | DEPTH (feet) | CLASSIFICATION |
|---|---|---|---|
| + | AB-2 | 50.0 | BROWN CLAYEY SAND (SC*) |

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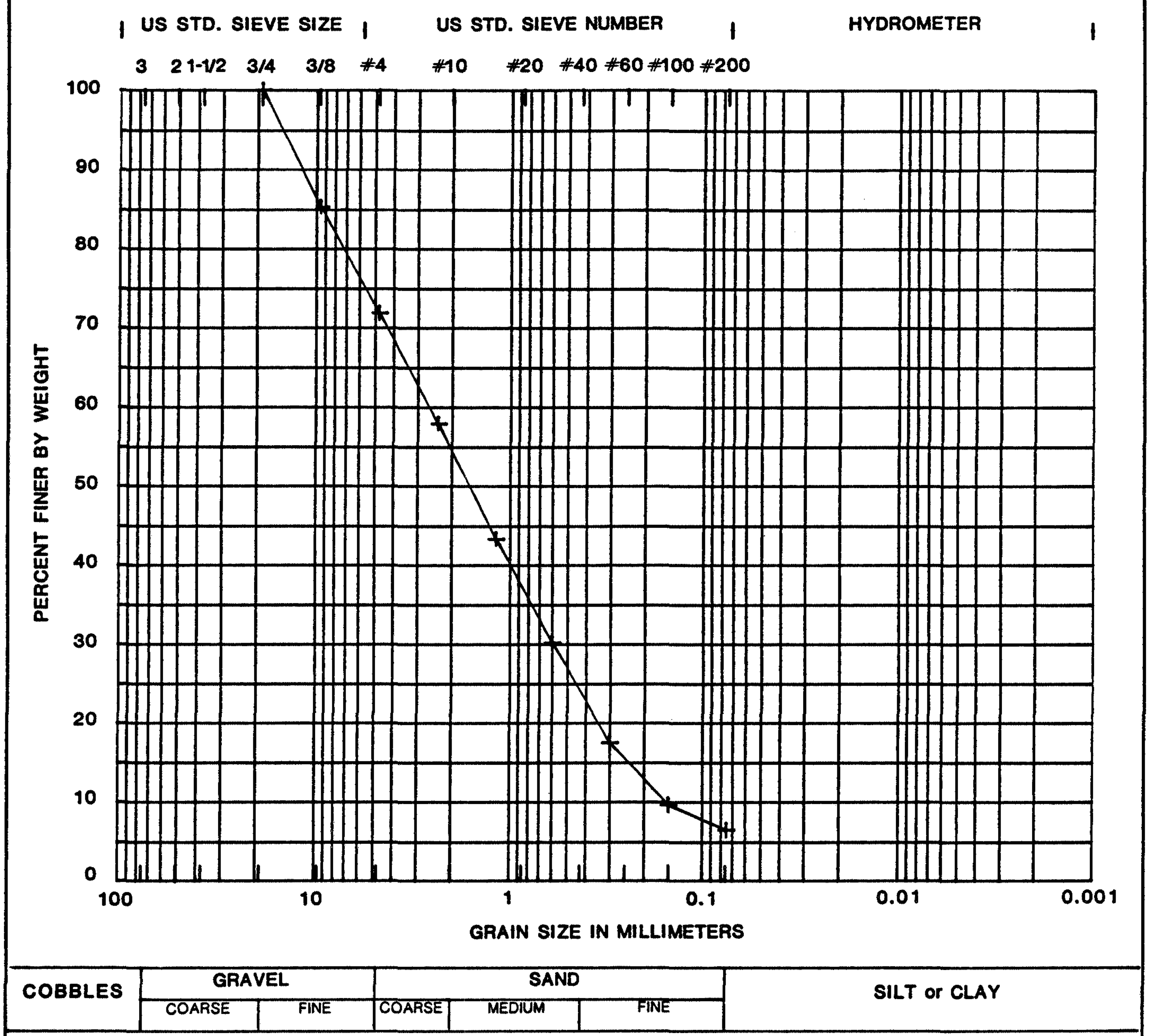
## Particle Size Analysis

PLATE

| DRAWN | JOB NUMBER | APPROVED | DATE | REVISED | DATE |
|---|---|---|---|---|---|
| | 05561.071.01 | | 10/87 | | |



| SYMBOL | BORING NUMBER | DEPTH (feet) | CLASSIFICATION |
|---|---|---|---|
| + | AB-3 | 10.0 | BROWN SAND W/SILT (SP-SM*) |

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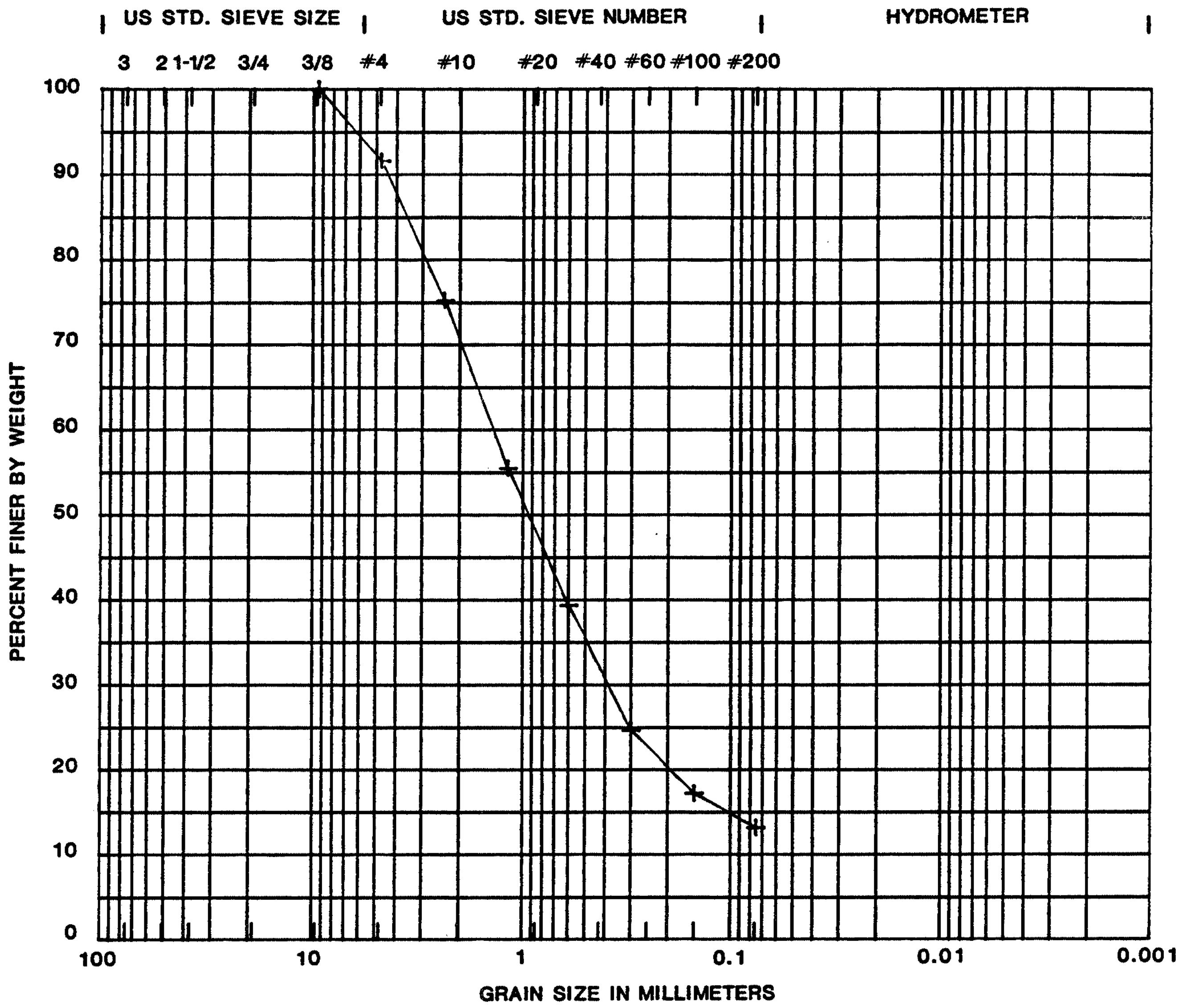
## Particle Size Analysis

PLATE

| DRAWN | JOB NUMBER | APPROVED | DATE | REVISED | DATE |
|---|---|---|---|---|---|
| | 05561.071.01 | | 10/87 | | |



| COBBLES | GRAVEL | | SAND | | | SILT or CLAY |
|---|---|---|---|---|---|---|
| | COARSE | FINE | COARSE | MEDIUM | FINE | |

| SYMBOL | BORING NUMBER | DEPTH (feet) | CLASSIFICATION |
|---|---|---|---|
| + | AB-3 | 65.0 | BROWN SILTY SAND (SM*) |

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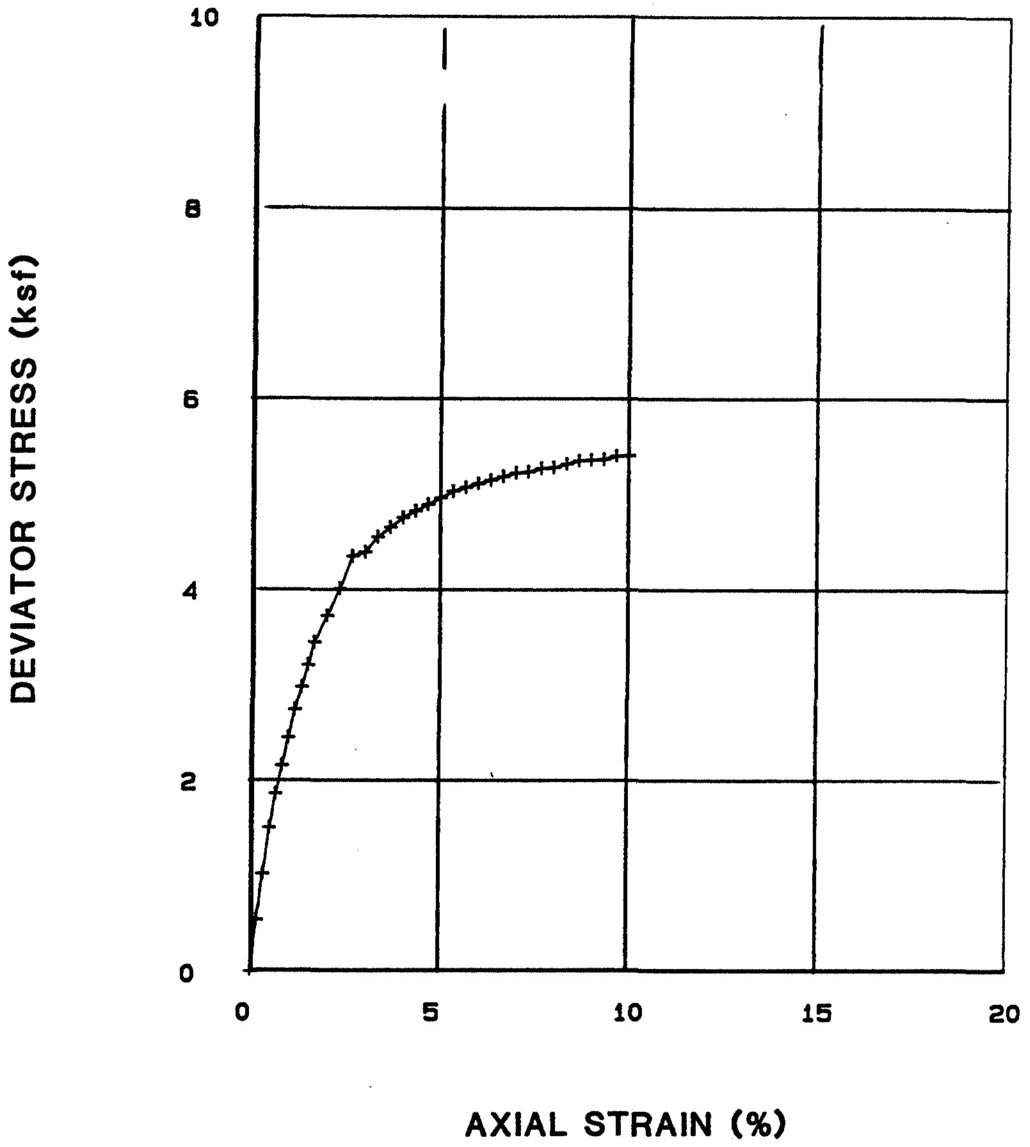
## Particle Size Analysis

PLATE

| DRAWN | JOB NUMBER | APPROVED | DATE | REVISED | DATE |
|---|---|---|---|---|---|
| | 05561.071.01 | | 10/87 | | |



| | | | | | |
|---|---|---|---|---|---|
| SPECIMEN TYPE | UNDISTURBED | | SHEAR STRENGTH | 2702 | psf |
| DIAMETER (in) | 2.87 | HEIGHT (in) 6 | STRAIN AT FAILURE | 10 | % |
| MOISTURE CONTENT | 20.0 | % | CONFINING PRESSURE | 2300 | psf |
| DRY DENSITY | 111 | pcf | STRAIN RATE | .6 | %/min |
| CLASSIFICATION | BRN SNDY CLAY W/GRAV | (CL | SOURCE | AB-1 | @ 50.0 ft |

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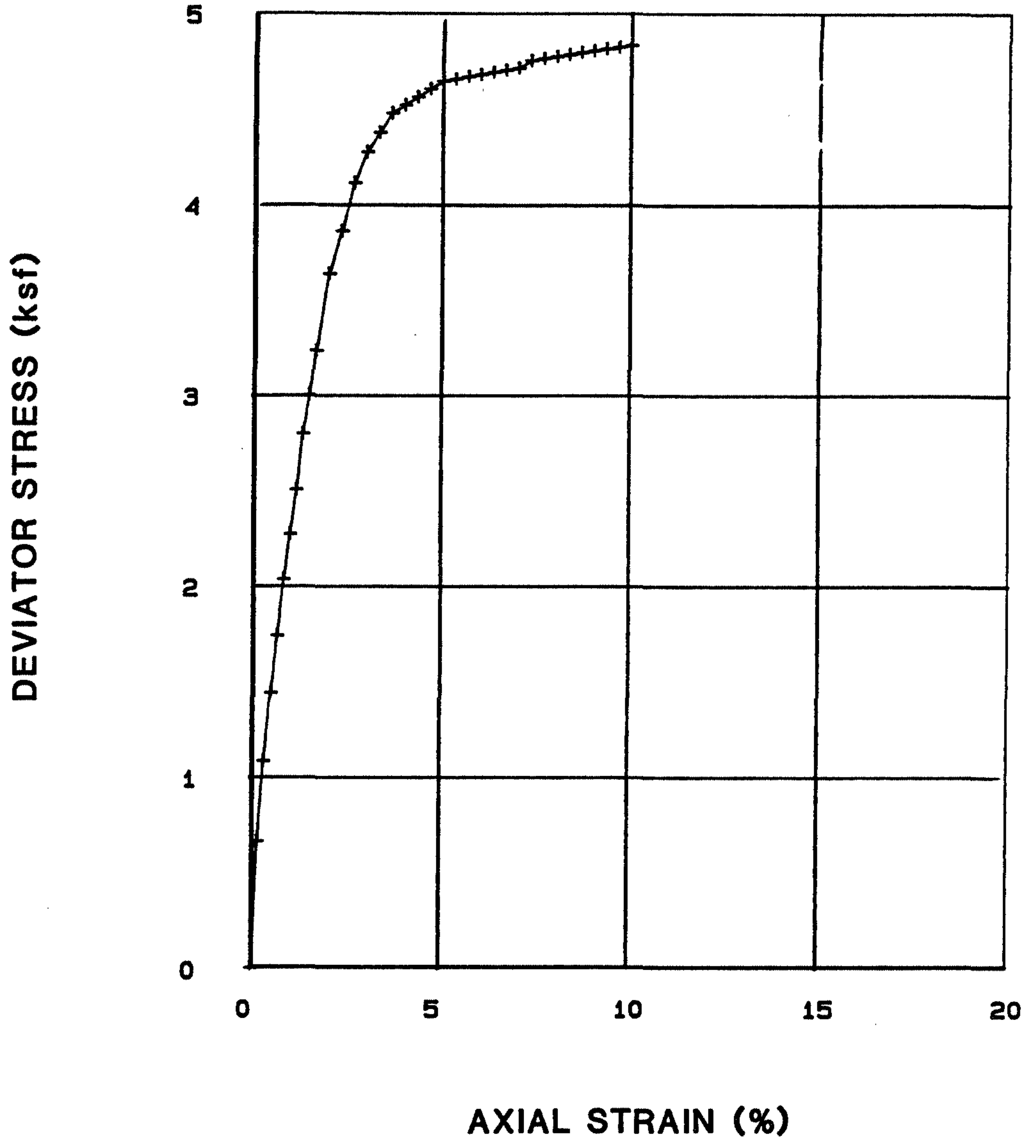
## Unconsolidated-Undrained Triaxial Compression Test Report

PLATE

| DRAWN | JOB NUMBER | APPROVED | DATE | REVISED | DATE |
|---|---|---|---|---|---|
| | 05561.071.01 | | 10/87 | | |



| | | | | | |
|---|---|---|---|---|---|
| SPECIMEN TYPE | UNDISTURBED | | SHEAR STRENGTH | 2417 | psf |
| DIAMETER (in) | 2.87 | HEIGHT (in) 6 | STRAIN AT FAILURE | 10 | % |
| MOISTURE CONTENT | 20.4 | % | CONFINING PRESSURE | 1600 | psf |
| DRY DENSITY | 110 | pcf | STRAIN RATE | .6 | %/min |
| CLASSIFICATION | BRN SNDY CLAY W/GRAV (CL) | | SOURCE | AB-3 | @ 30.0 ft |

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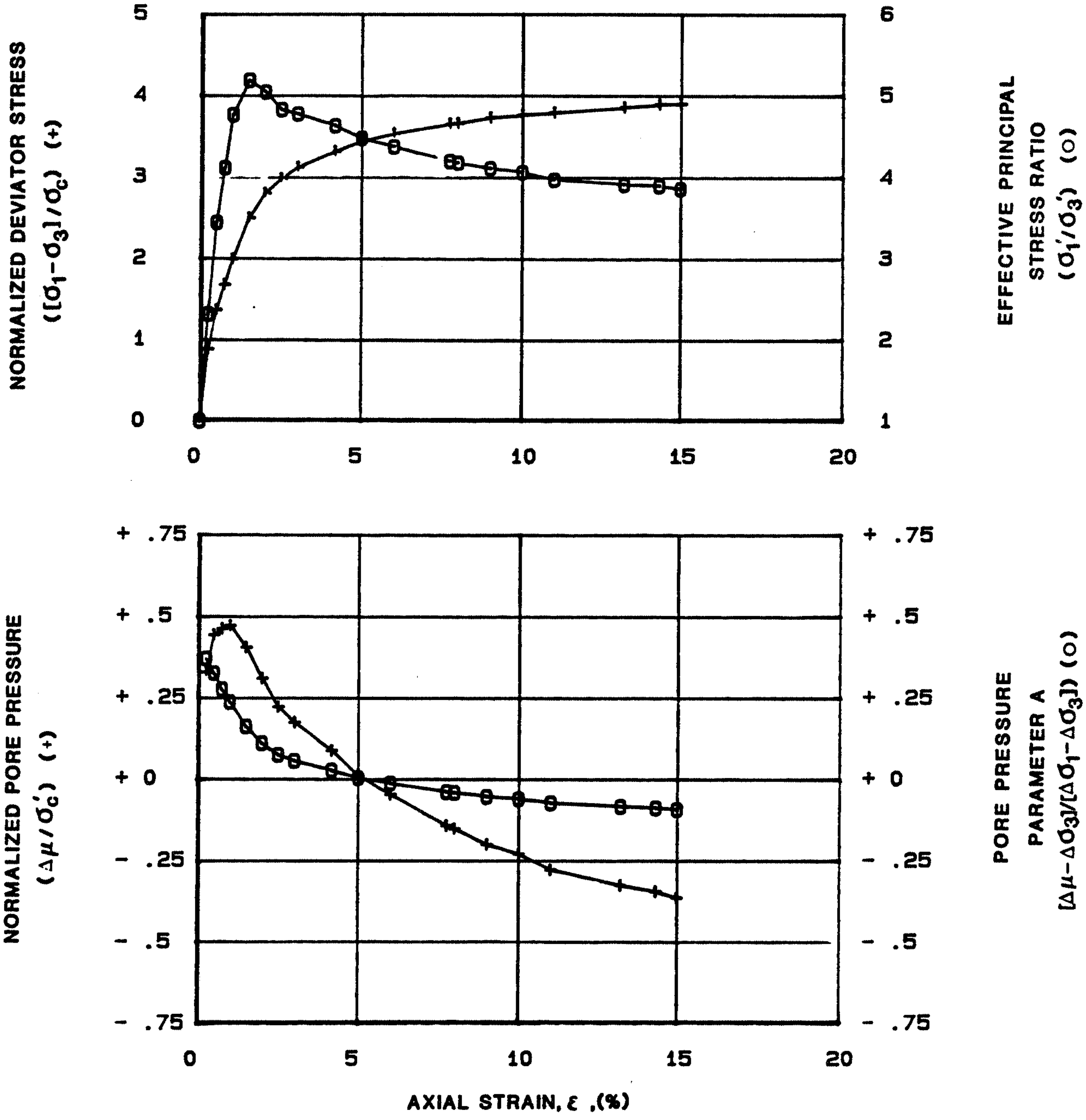
## Unconsolidated-Undrained Triaxial Compression Test Report

PLATE

| DRAWN | JOB NUMBER | APPROVED | DATE | REVISED | DATE |
|---|---|---|---|---|---|
| | 05561.071.01 | | 10/87 | | |



| | | | | | | | |
|---|---|---|---|---|---|---|---|
| SPECIMEN TYPE UNDISTURBED | | BEFORE TEST | | | AFTER TEST | |
| DIAMETER (in) 2.87 | HEIGHT (in) 6.5 | MOISTURE CONTENT | $w_o$ | 23 % | $w_f$ | 23.1 % |
| OVERBURDEN PRESSURE, $\sigma_{vo}'$ psf | | VOID RATIO | $e_o$ | 0.648 | $e_f$ | 0.651 |
| CONSOLIDATION PRESSURE, $\sigma_c'$ 1500 psf | | SATURATION | $S_o$ | 100 % | $S_f$ | 100 % |
| STRAIN RATE .14 %/min | | DRY DENSITY | $\gamma_d$ | 106.8 pcf | $\gamma_d$ | 106.8 pcf |
| LIQUID LIMIT | PLASTIC LIMIT | PLASTICITY INDEX | | SPECIFIC GRAVITY 2.82 | | |
| CLASSIFICATION GREY SANDY CLAY W/GRAV. (CL) | | SOURCE AB3ST4 @ 22.0 ft | | | | |

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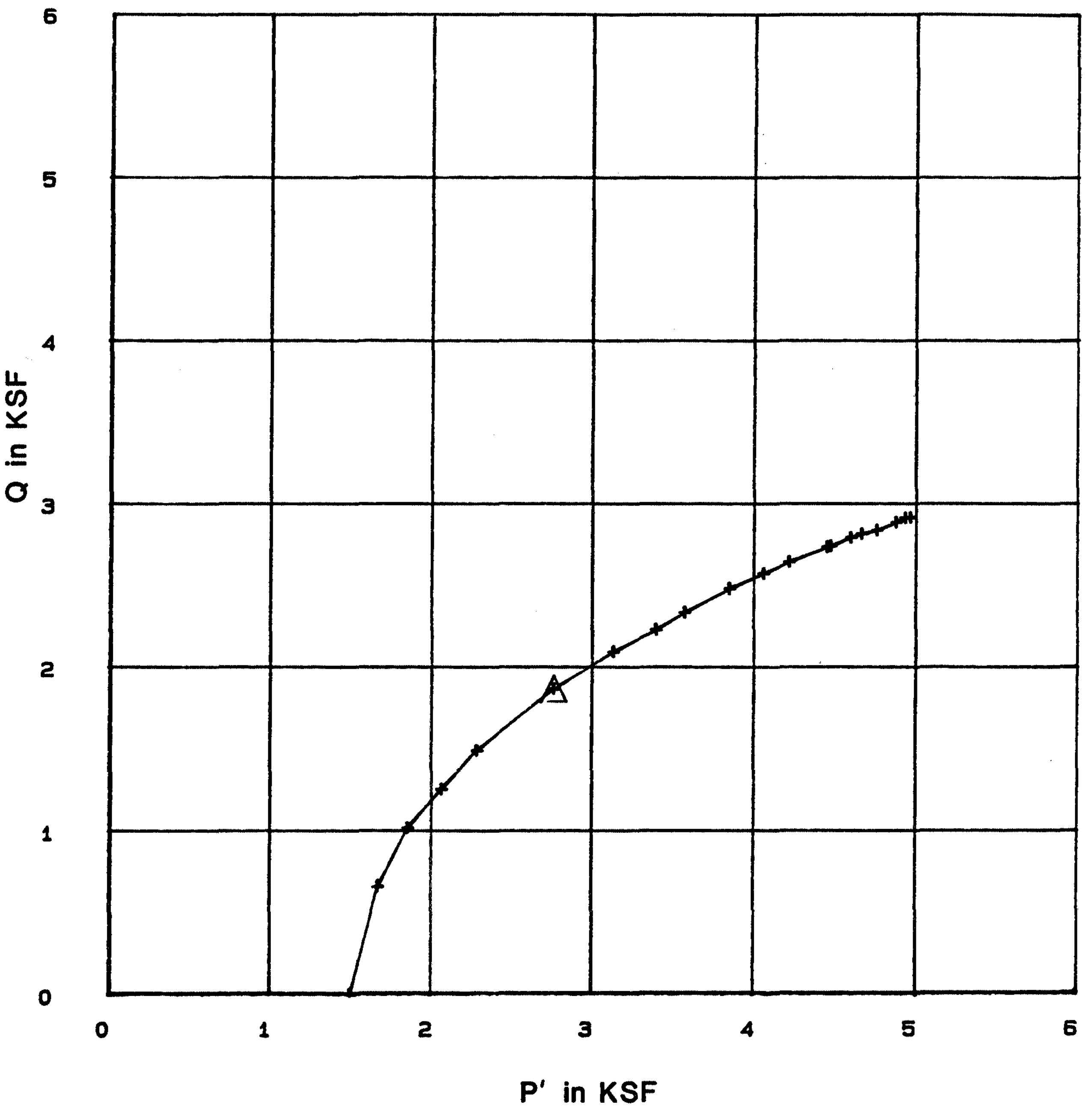
## Consolidated-Undrained Triaxial Compression Test Report

PLATE

| DRAWN | JOB NUMBER | APPROVED | DATE | REVISED | DATE |
|---|---|---|---|---|---|
| | 05561.071.01 | | 10/87 | | |



△ Maximum Effective Stress Ratio

SOURCE: AB3ST4 @ 22.0 ft

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**Effective Stress Path Consolidated-Undrained**
**Triaxial Compression Test Report**

PLATE

| DRAWN | JOB NUMBER | APPROVED | DATE | REVISED | DATE |
|---|---|---|---|---|---|
| | 05561.071.01 | | 10/87 | | |